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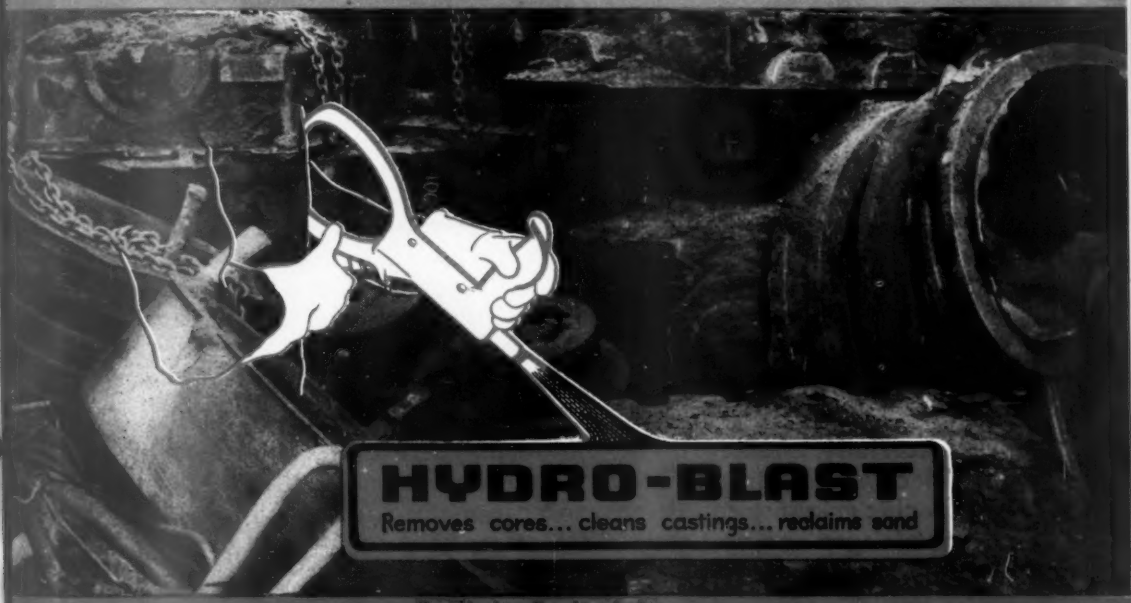

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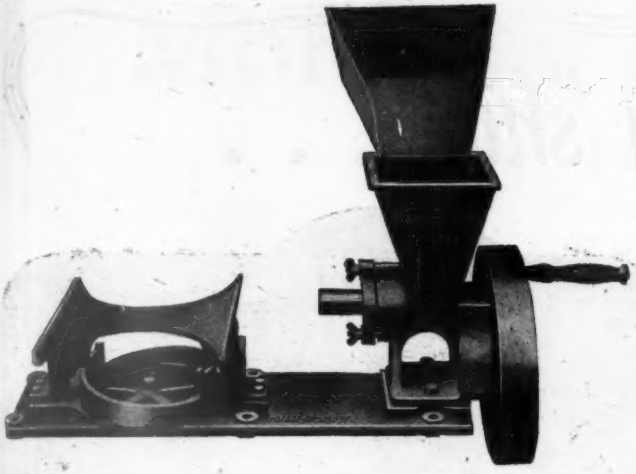

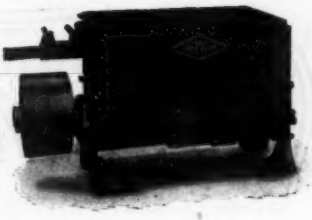

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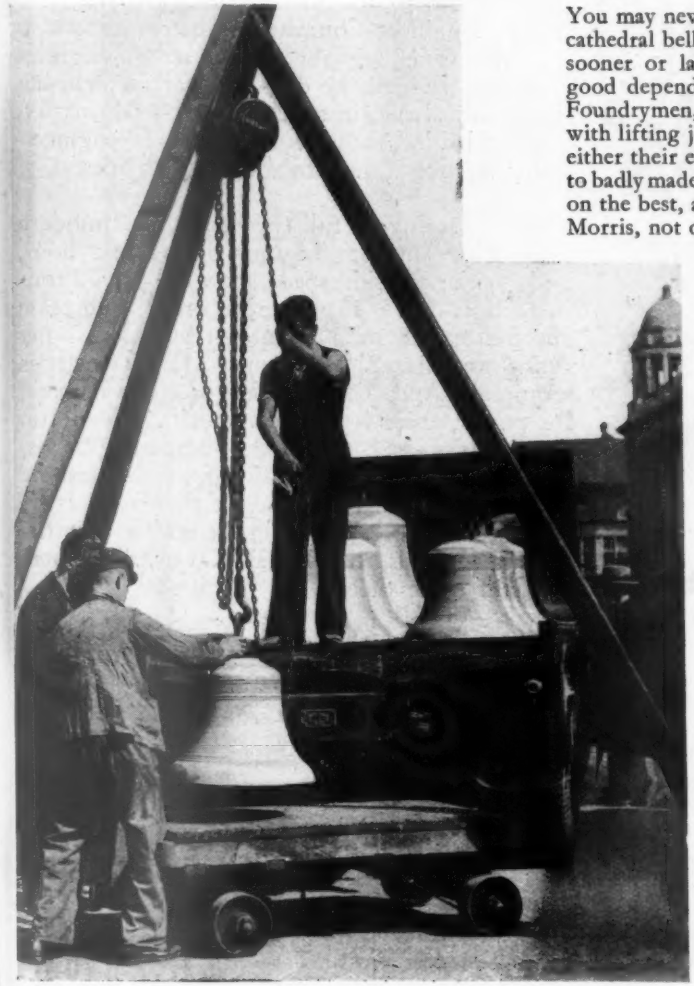

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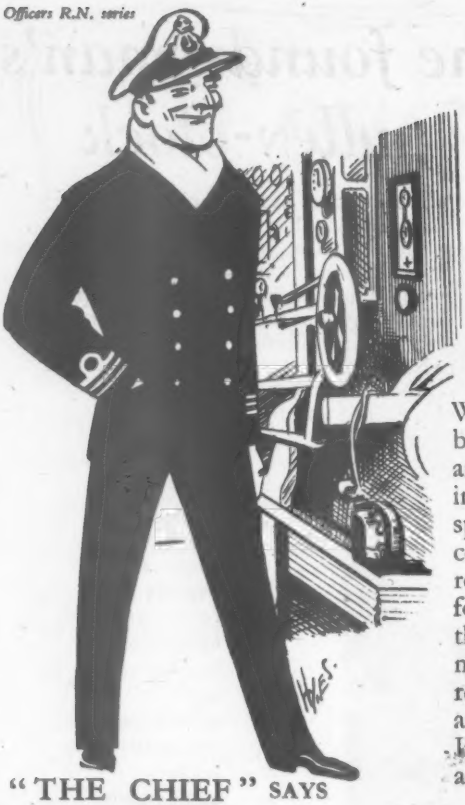

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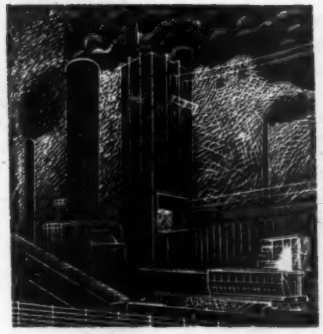

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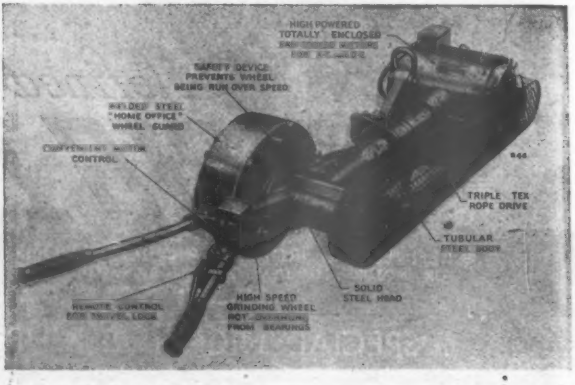
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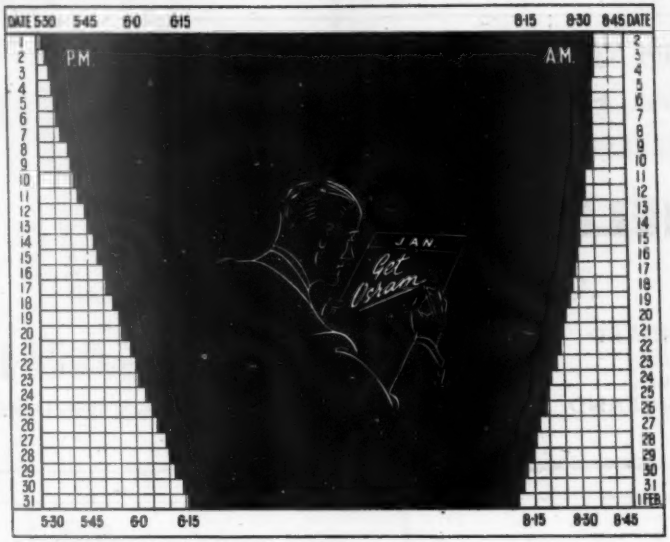

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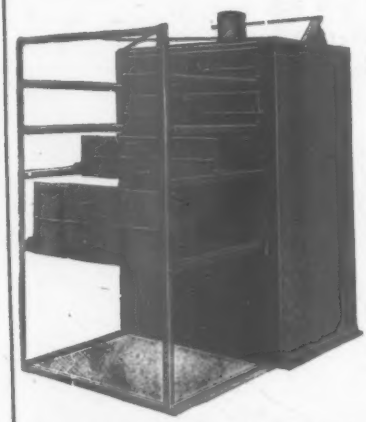

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Vol. 71 Thursday, December 30, 1943 No. 1428

Yield

It is not only in the postulation of the mechanical properties of an alloy that "yield" is of paramount importance, but Mr. Colin Gristy in a Paper to a Fuel Conference held in Newcastle has shown that the yield of castings per ton of iron charged into the cupola is the most important factor in any foundry fuel economy campaign. He cites an example taken from practice. Since the war, a real effort had been made to improve the yield of castings as related to the liquid metal melted. As a result the yield rose from 54 to 64 per cent. If the yield had remained at the lower figure the whole time, the amount of coke consumed would have been approximately 900 tons more than it actually was. In a second foundry the yield has been increased from 50 to 63 per cent. in the same period. The great advantage of tackling the fuel economy problem from this angle is that no major changes need be made in the operation of the furnaces, as the yield figure is boosted up by good planning. Good planning ensures that there is little or no over-metal to be remelted and thus use up more good coke. Good planning will ensure that in any month the cupola is run on as few occasions as possible as each blow requires coke for heating up a big mass of refractory materials to about 1,300 deg. C. Thus, longer blows at longer intervals make for fuel economy. Good planning ensures the synchronisation of that big mould completion with the production of the requisite metal. Delays in this respect often cause excess metal to be melted and pigged. A revamping on the runner and riser system can also effect a real saving of fuel, but it is unwise to pursue such experiments concurrently with any alterations in cupola practice, because, if two important factors be changed simultaneously and wasters result, it is next to impossible to localise the trouble. Investigations conducted over the whole country have shown that British cupola practice is in general fairly efficient, and high coke ratios are normally ascribable to processing conditions and not to ignorance. Not infrequently it is found that the cupolas are somewhat on the short side, and in many cases improved fuel consumptions have been attained through raising the charging door sill by a few feet. It is easier for the outsider to suggest longer blows at less frequent intervals, than for the jobbing founder to risk holding up his best customer's apparently vital production. Again there are the limitations imposed by the availability of floor space and box parts. Still, by planning, much can be accomplished as Mr. Gristy has so clearly proved. The attached machine shop can be as insistent for deliveries as the outside customer and can bring excessive pressure to bear. The obliging of the best customer by the jobbing founder can be an expensive undertaking if it cuts across his planned production. This "obliging" may take the form of making castings which are really too big to be handled economically by the lifting tackle available; preferential delivery; over-complicated components; accepting orders for castings demanding exceptional physical properties; and so forth. This type of obliging not only affects the "yield" of good castings per ton of iron melted but the yield of the whole foundry. Mr. Gristy has undoubtedly done good service in drawing the attention of the industry to this factor of "yield."

Indexes to the "Foundry Trade Journal," Vols. 69 and 70, are now available, and may be obtained on application to the Publishers of the Journal, at 3, Amersham Road, High Wycombe, Bucks. Applications should include requests for the Index to Vol. 71, which will be ready early in January.

Contents

Yield, 339.—Repair of War Damage in Belgium, 340.—American Grey-Iron Casting Industry, 340.—The Syphon Brick Method of Cupola Tapping, 341.—The Carbide Phase in High-Silicon Iron-Carbon Alloys, 345.—Sprayed-on Vitreous Coating, 345.—W.P.B. Aluminium and Magnesium Progress, 346.—Quality of Castings begins in the Foundry, 347.—Die-Cast Chuck Jaws, 352.—Heavy Castings in Green Sand, 353.—News in Brief, 355.—Company Results, 355.—Personal, 355.—The Future of Tin, 356.—New Trade Marks, 356.—New Companies, 356.—Weight-Lifting in Industry, 358.—Galvanising Restrictions Relaxed, 358.—Obituary, 358.—Adamson-Horsehay Associated, 358.—National Board for the Iron-Ore Industry, 358.—Industrial Salvage, 358.—Raw Material Markets, 360.

REPAIR OF WAR DAMAGE IN BELGIUM

The General Commissariat for the Reconstruction of Belgium, in Brussels, has published particulars of the position in respect of the repair of war damage at June 30, 1942. The damage due to the war has been on a considerable scale. For the purposes of the statistics, war damage is divided into three classes: slight damage, serious damage, and complete destruction; and this classification applies to each of the following types of property affected:—(*a*) dwelling houses; (*b*) factories and industrial establishments; (*c*) public buildings; (*d*) highways; (*e*) civil engineering works. A military campaign lasting 18 days and two years of war conditions have produced the following results:—Dwellings damaged, 195,355, of which 5.87 per cent. were entirely destroyed; 16.42 per cent. seriously damaged; 77.71 per cent. slightly damaged. Factories and industrial establishments damaged, 3,430, of which 13.09 per cent. were completely destroyed; 33.53 per cent. seriously damaged; 53.38 per cent. slightly damaged. Civil engineering works destroyed, 1,787. With regard to damage to industrial property, the textile industry suffered most severely, with 815 establishments damaged, of which 143 were completely destroyed, 259 seriously damaged, and 413 slightly damaged. There were 466 commercial establishments damaged, of which 72 were completely destroyed, 146 seriously damaged, and 248 slightly damaged. Next in order come the food industries with 376 establishments damaged, the metal industries with 336, agricultural undertakings with 238, and the wood and furniture industries with 219. The 1,787 civil engineering works destroyed or damaged include 1,462 bridges, 131 aqueducts and culverts, 90 sewers, 28 locks, and 76 miscellaneous works.

Most of the industrial damage has already been repaired, with the exception of 269 undertakings completely destroyed, 387 seriously damaged, and 281 slightly damaged. Rebuilding is most advanced in, *inter alia*, precision engineering, metal (79 per cent.), and mining, wood and furniture, and hides and leather (78 per cent.). The rebuilding of commercial establishments (48 per cent.), tobacco factories (58 per cent.), and pottery works (59 per cent.) is less advanced. Present circumstances are not favourable to a policy of reconstruction, and many difficulties are encountered. Not only does it take time to clear away the ruins and make building plans in conformity with a town-planning policy, but there is an increasing shortage of building materials, and increasingly severe restrictions on the use of transport complicate the supply problem. Lastly, it is stated that the rebuilding of part of West Flanders, in particular the coastal area, has hardly been contemplated yet, according to reports dated last spring.

Col. Charles Batchelor, a veteran of the Scottish steel and iron trade, died at Dundee on December 16. He started the merchant firm of Charles Batchelor & Company nearly 50 years ago, and carried on an extensive business. He retired some 10 years ago. He was early associated with the Volunteer movement.

AMERICAN GREY-IRON CASTING INDUSTRY

The American grey-iron industry, with some 2,900 small foundries, will head for a long series of new annual production records in the post-war future and attain a sales volume of $2,000,000,000 or more as America goes all-out for peace, considers W. W. Rose, executive vice-president of the Grey Iron Founders' Society. He added that the forecast is predicated on the assumption that business will be unhampered in its efforts to meet civilian demands and the needs of devastated countries and that government-built facilities in the metals field will not be permitted to influence competitive relationships.

A tremendous tonnage of iron castings will be needed to rebuild transportation, to provide farm and farm product processing equipment, and to repair, modify and furnish production machinery of all kinds, Mr. Rose anticipates. New product development, modernisation, construction on an unprecedented scale and the great quantities of metal-using goods required to rehabilitate Europe and industrialise the world will place large and increasing orders with grey-iron producers as peacetime production gets under way, he said.

The change-over to production for peace will be a signal for battle between alternate engineering materials, Mr. Rose maintained, but he stressed that grey iron has not been replaced in essential functions and that most manufacturers are expected to stick with materials of long-record performance and to pre-war processes. Automobile manufacturers, for example, have indicated that the materials in post-war cars will be largely those used in pre-war days, he pointed out, adding that materials replacement is likely to be less than 20 per cent. and that, as a result of wartime experience, many of the substitutions will be in favour of grey iron.

A definite threat to grey iron's future, he warned, is the huge American Government's investment in steel, aluminium and the productive capacity of other engineering materials. The grey-iron industry faces no reconversion problems, Mr. Rose said, and is ready to shift from output for war as soon as it obtains release.

Peak year on the books of the grey-iron industry is 1942, when production of grey-iron castings, mainly for war service, reached 14,500,000 tons. In 1943, with the industry forced to turn down increasing orders as a result of its crucial man-power situation and "squeezed" prices, grey-iron casting production is expected to be in the neighbourhood of 12,000,000 tons.

A.B. Svenska Metallverken, Vasteras, produced 14,211 tons of non-ferrous metals in 1942, against 17,739 tons in 1941. Last year this concern absorbed the Finspongs-Metallverken, which have an annual output of 12,918 tons. Exports were reported to have been very small in 1942, while outputs declined.

THE SYPHON BRICK METHOD OF CUPOLA TAPPING

By E. R. DUNNING

The use of a syphon brick facilitates metal handling and slagging procedure

The expansion of mass production methods in the foundry industry has stimulated the interest of many foundymen in the "syphon brick method" of metal distribution. The increasing number of requests for information about it have made it appear that a Paper on the subject is long overdue.

The object of using the syphon brick is primarily to cut out the tapping and botting up of the cupola tap-hole each time metal is drawn off. With this system in operation the presence of a skilled cupola man at the furnace spout is unnecessary, as the orifice from which the metal is drawn is continually open to the atmosphere. The flow of metal is controlled by shutting the blast on and off. The name syphon brick is anomalous in so far as it implies the syphoning of a liquid from one level to another. The working of the syphon brick is dependent on the difference in atmospheric pressure between the interior and exterior of the furnace.

Fig. 1 shows a sectional view of the syphon brick before fitting in the cupola. Fig. 2 shows the well of a furnace incorporating a syphon brick arrangement. It will be seen that the metal is exposed to the atmosphere at point B through a channel which is similar to the spout of a teapot ladle. Under static conditions, that is to say without the blast on, the atmospheric pressure at A inside the cupola well and at B at the cupola spout are the same, therefore the metal will not flow down the spout. If the blast is put on, the pressure inside the well will be greater than that at the spout, and the level of the metal in the well will be depressed, causing it to rise in the channel and flow over. Further, when the blast is on metal will be melting in the melting zone replacing the overflow. Since the difference in level of A and B will be constant with the blast pressure, the amount of metal melted will be equal to the amount of metal drawn off. Thus a constant quantity of fluid metal is retained in the well. This is an advantage in that it removes any danger of metal rising to the tuyeres or conversely of there being too little metal to ensure a thorough mixture.

Metal Handling

The ease with which the metal flow can be controlled allows of the use of quite small ladles at the cupola, and there is no need for a re-distribution from a large ladle such as is often necessary when tapping out. In the author's foundry 40-lb. capacity steel ladles are used, suspended from a mono-rail which runs along the pouring station. The ladles are supported in a bewel with a hook at the front and hung on a steel

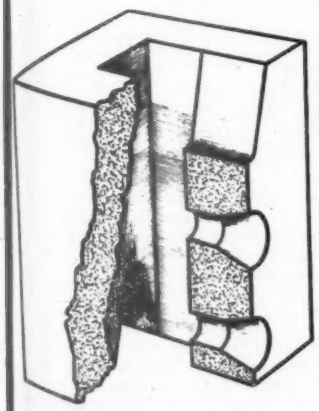


FIG. 1.—SECTIONAL VIEW OF SYPHON BRICK.

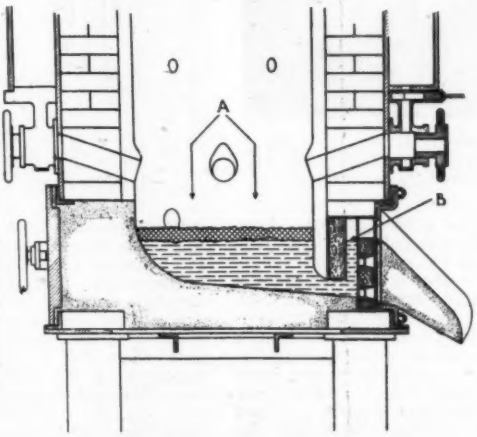


FIG. 2.—SECTION OF CUPOLA WELL WITH SYPHON BRICK.

FIG. 3.—LADLE SUSPENSION FROM MONORAIL.

Syphon Brick for Cupola Tapping

rod with a sling chain to slide over the bewel handles, as shown in Fig. 3. Conveyance of the metal to the hand moulders who are not served by a common pourer is done in trucks with rubber tyred wheels which carry two ladles at once. This is made possible by virtue of the fact that the foundry possesses a good concrete floor over which the trucks will run smoothly. Fig. 4 shows one of these trucks being drawn by a woman.

The syphon brick can be made in ganister in the foundry by the use of a suitable core-box and dried in the core stove, or it may be bought ready-made as a fired brick constructed of highly refractory metal. It will be shown that the use of the fired brick is the more economical because of its longer life.

Slight modifications to the furnace are necessary to ensure the satisfactory operation of the brick. The back of the brick needs some protection from direct contact with the metal in the well of the furnace,

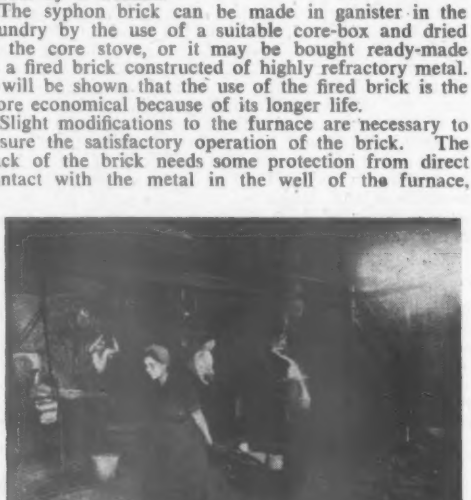


FIG. 4.—PHOTOGRAPH SHOWING METHOD OF CARRYING MOLTEN METAL IN RUBBER-TYRED TRUCKS. NOTE THE LADLES SUSPENDED ON MONORAILS.

otherwise it will be working under excessive heat, and, with molten metal on both sides of it, it may break down in service or, at any rate, its life would be reduced. Experience has shown that the amount of lining behind the brick should not be less than 2 in., and could be as much as 5 in. The limiting factor here is the length of tap-hole which will result from a thick lining, and, to keep this as short as possible, the lining should be cut into a wide lead right down to the brick itself, as shown in Fig. 2. Where the cupola is operating at its maximum capacity and has therefore got a minimum thickness of lining, the brick is best mounted in front of the furnace breast, but where the lining is excessively thick it may be placed inside the shell as part of the lining. A third arrangement is to mount the brick in a detachable box on the breast of the cupola, which can be removed daily for cleaning and fettling. This last arrangement has the advantage of easy removal in the event of trouble, such as metal or slag chilling in the channel, and allows of the temporary return to an ordinary tapping arrangement should this be required. Fig. 5 shows these three arrangements A, B and C, and also at D shows a brick fitted in such a way that it will receive no protection from the metal in the well, and hence this arrangement should be avoided.

Installation Details

The brick can be most easily fitted from the front outside of the cupola. This necessitates providing a removable breast plate which is slotted to expose the front portion of the brick. If this be not provided and the brick has to be fitted from the inside, con-

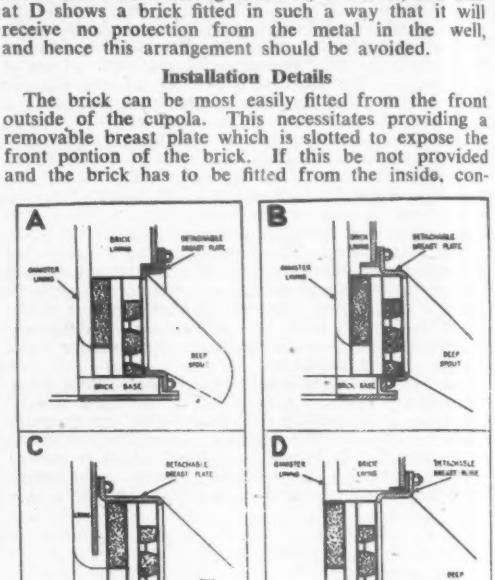


FIG. 5.—A, B & C ARE THREE ARRANGEMENTS OF SYPHON BRICK FITTING; D SHOWS AN INCORRECT ARRANGEMENT.

siderable damage may be done to the lining in the process, although even this would not be seriously inconvenient if the life of a brick were in the neighbourhood of 6 to 9 months, and the refitting could be carried out during holiday times or at week-ends.

The provision of a deep spout is necessary so that a suitable runner can be built up in sand to the top hole, when this is in use. It is important that the operation of the main blast valve should be easily accessible and free of movement. The method of achieving this depends upon the position of the valve and the type and disposition of the cupolas. It can usually be managed by means of crank levers, but the mechanical arrangement adopted is unimportant so long as easy operation is achieved and

the point of operation gives a good view of the furnace spout, so that control is visual.

Technique of Operation

Assuming the syphon brick to be fitted to the furnace and all the foregoing modifications carried out, the method of operation is as follows:—The cupola fire is lighted about 4 hours before it is required to blow down, and the coke bed and charges are put on. The blast is put on with all the holes in the brick open. Hot blast coming through the tap-hole will preheat the brick and minimise the risk of metal chilling it. Iron should appear at the tap-hole in about 12 mins. from putting on the blast, and should be allowed to run down the spout until it is flowing freely with a temperature of about 1,350 deg. C.

In the author's foundry this usually means that between 1 cwt. and 1½ cwts. of metal are thrown away from the bottom hole. At this point the bottom hole is botted up and the metal will collect in the channel and well. A certain amount of splashing will occur until the bath is deep enough to submerge the hole in the back of the brick, and then the metal will rise quietly and flow out of the second hole. This takes about 3 mins., and during this time sand should be rammed into the spout to give additional support to the bot at the bottom and to the brick front up to the second hole. The metal rising in the channel will be slightly colder by the time it reaches the second hole, and a further quantity should be drawn off (about the same amount as from the bottom hole) before the second hole is botted up. The metal will now collect until the well is full and rise to flow out of the top hole.

Before closing the second hole, care should be taken to see that there is no slag lying on the top of the metal in the channel as this may freeze before reaching the top and cause a stoppage. Should this occur the second hole must be opened immediately, and steps taken to break the solid slag away. During the whole of the blowing down operation the blast must be kept on, as it is necessary that the metal shall be kept on the move. A momentary shutting off of the blast is permissible when botting up the bottom hole to allow the operator to ram the bot securely home, otherwise the blast must be on all the time. The time required to carry out the operation of blowing down, from putting on the blast to drawing metal off the top hole, is not longer than 20 mins., and may be less if the melting rate of the cupola is high. The foregoing procedure must be carried out with great care, and if this is done the cupola will work for many hours without any further attention to the top hole. The author has worked cupolas in this way for periods of 18 hrs. a day for five years, and has never experienced any serious difficulties.

"Iron" Holes

It is during the blowing down period that "iron" holes occur unless the proper care is taken. They may occur in the usual manner if the back hole is stopped by a piece of coke, or the first metal is running cold. If this should happen and the back hole is stopped it may be treated in the ordinary way and knocked out with a bar, but this case will not arise if conditions are correct.

A more difficult state of affairs exists, if the metal chills after botting up the bottom hole when metal will have risen in the channel and set solid there too. This may be caused by closing the bottom hole too soon before the metal is sufficiently hot and fluid. It can also be caused if the back wall of the brick is cracked, allowing blast from inside the furnace to blow through into the channel and impinge on the metal rising there causing it to solidify. In this case the length of solid metal is 9 in. long or more, and is keyed into the brick channel. It will not be possible to free this with a bar, and even if it was there is a danger of cracking the brick. The method best employed is to burn out the hole with the aid of oxygen. A length of about 10 ft. of conduit tubing is connected to an oxygen cylinder by means of a rubber tube. The open end of the conduit is inserted in a tuyere and heated. This is then pushed against the front of the chilled bottom hole and the oxygen is turned on. The heat at the end of the tubing will be further intensified and the metal will melt. The conduit tubing will also melt and will be used up. A further supply of conduit should be to hand in case the hole is not fully cleared with the first length. Using this method the opening of the hole is assured, and no violence is used to damage the syphon brick. The process of burning out is very rapid, 5 mins. being sufficient to clear through to the well.

This will not melt out the metal in the channel of the brick, and the cupola must now be worked by tapping and botting while a new channel is built up in front of the old one. This is referred to as a "false" syphon, and is made by placing a brick split 9 in. by 4½ in. by 1 in. in front of the syphon brick and fixing it securely in position with ganister, leaving a space at the bottom open so that tapping out can proceed meanwhile. The ganister is allowed to dry thoroughly, and then the new bottom hole is closed and the metal will rise in the false syphon. Sand is firmly rammed against the front of the new brick to support it and a new spout cut in this. The arrangement will work as satisfactorily as the original syphon brick, and the heat radiated into the old channel will eventually melt out the stoppage there. All this can be done in the matter of 10 mins. if the materials are kept available, and no services hold-up need result from the occurrence of an iron hole.

This has been dealt with fully because it is believed many people consider the liability to "iron" holes is greater with the syphon brick than with the ordinary tapping arrangement and not because the author personally endorses this view. In fact, in the past five years of working a syphon brick, this has only occurred on eight occasions, and in each case has been due to not drawing sufficient metal from the bottom hole before going up the channel. On none of these occasions has it been necessary to stop production in the foundry.

After the blowing down operation is completed the metal may be drawn off as required, by operating

Syphon Brick for Cupola Tapping

the main blast valve. No further attention need be given to the syphon brick until the end of the melt, when it is required to empty the well. Metal should be drawn off regularly and sufficiently frequent to maintain a good temperature and fluidity in the channel. This time will depend to a great extent on the metallurgical character of the metal being melted. In the foundry in which the above observations were made, a No. 3 foundry iron with 3 per cent. carbon and 1.5 per cent. phosphorus giving a fluidity figure of not less than 40 in. was being used. This mixture allows of a standing period of 10 mins. between drawing off one ladle of metal and another. Metals containing a high percentage of steel scrap, or being of low phosphorus content so that fluidity was low, would not be considered suitable for use with a syphon brick.

FIG. 6.—PHOTOGRAPH SHOWING CUPOLA SPOUT WITH FRONT WALL CHIPPED OUT OF SYPHON BRICK.

Slagging Procedure

Slag must be drawn off at frequent intervals, as any quantity of it in the well will displace metal and reduce the well capacity. The slag hole is placed 1 in. above the level of the top hole in the brick. This allows for the retention of a layer of slag on the top of the metal at all times to prevent oxidation. Should the slag not be removed it will eventually fill the well to the exclusion of the metal bath and will flow into the channel and solidify. In practice it is found that if slagging out is done every hour this is satisfactory. When the slag hole is open the internal pressure is released and the flow of metal will be reduced. For this reason the period of slagging should be as short as possible. A fluid slag is necessary to facilitate this. It is not good practice to operate with an open slag hole in view of this loss of pressure, and where a syphon brick is used it is well nigh impracticable to operate in this way.

The output of the cupola will of necessity be reduced since the blast is shut off when metal is not being drawn, but the melting efficiency is not impaired. In fact, very good figures of efficiency have always been noted on the cupolas under my observation. The melting ratio is reduced in exact ratio to the time in which the blast is off, *e.g.*, a cupola lined to 36 in. dia. will give a melting rate of 4½ tons per hr. If metal is being drawn for 40 mins. of the hour then the melting rate will be 4½ by $\frac{40}{60}$ = tons per hr.

In practice it is found that a certain amount of incipient melting takes place even when the blast is shut off. This is due to the high temperature present in the melting zone, and gives a slightly better melting rate than the direct time ratio, but this quantity is very small and for all practical purposes can be ignored.

FIG. 7.—PHOTOGRAPH SHOWING SYPHON BRICK WITH FRONT WALL REMADE IN GANISTER. NOTE THE BENT STEEL TOOL USED FOR THIS PURPOSE.

Preparation of the Brick

At the end of the blow it is necessary to drain the cupola before dropping the bottom. The blast is shut off and the sand scraped away from the second hole. This is opened and the metal above this level drained off. The same procedure is adopted with the bottom hole which remains open until slag runs from it. When this happens slag will rise in the base of the channel and solidify there. This will have to be dealt with during the fettling of the brick.

This leads to what is perhaps the most important item in the successful and economic operation of the syphon brick system:—The preparation and fettling of the brick. It will be apparent that the essentials of operation are a clean and open channel free from congealed slag and iron and a strong structure which will stand up to a certain amount of rough handling. It has already been shown that after dropping the bottom a deposit of solid slag is left in the channel.

This must be removed, and its enclosure in the brick cavity renders it inaccessible so that this removal is difficult and may not be thorough. In addition to this, if there are any cavities or cracks in the back of the channel, their repair will prove to be very difficult while the front wall is in position. It has been found that the most practical way of repairing the brick is to chip out the front wall after each melt, thus exposing the interior of the channel for cleaning and repair. A glance at the photograph of the syphon brick with the front wall removed (Fig. 6) clearly illustrates this.

The front must now be built up again with strong ganister, and by the aid of the bent steel strip shown in Fig. 7. This shows the front wall re-made in ganister with three holes as in the original brick. This wall is naturally not so strong as the one which was integral with the brick but, if carefully dried out and supported by sand rammed up against it during operation, it is quite strong enough. It can now be seen why a fired brick is more suitable than one made of ganister. The ganister brick will be friable and might be seriously damaged during the chipping out of the front wall, while the fired brick is sufficiently strong to stand this any number of times.

A new brick need only be fitted when the old one has worn thin at the back and when the cupola well is relined. The two cupolas under personal observation have been fitted with a new brick each, once every 12 months. At 25s. each the cost is far below that of frequent fitting of home-made ganister bricks.

Basic Conditions

When considering the use of a syphon brick in a foundry the following points must be borne in mind:—A demand for regular and even supply of metal is necessary as the metal cannot be held in the well for an indefinite period. The metal must be of a very fluid nature, and should preferably be confined to one mixture per melt. Where a variety of mixtures is required it would be necessary to drain the well in between each. Since the well cannot be drained without passing slag into the channel, it may not be possible to bring the metal up to the top hole again after once going down. If it is required to operate with a syphon brick on occasional days, arrangement Fig. 5 should be adopted so that the syphon brick can be removed when it is not required.

The following figures were recorded recently on two balanced-blast cupolas fitted with a syphon brick and working for 9¼ hrs. a day on alternate days, and will serve to show that efficient operation is possible with this arrangement:—

Internal diameter...	30 in.
Weight of charge	8 cwts.
Time wind was off in any hour...	20 mins.
Actual metal drawn	2.25 tons per hr.
Slagging period	5 mins. per hr.
Coke ratio	9.7 : 1 total.

Finally, acknowledgments are due to the Midland Electric Manufacturing Company, Limited, for permission to use data presented in this Paper.

THE CARBIDE PHASE IN HIGH-SILICON IRON-CARBON ALLOYS

DR. J. E. HURST and DR. R. V. RILEY are presenting to the Iron and Steel Institute a Paper, which records the presence of a carbide constituent in commercial iron-carbon-silicon alloys containing 10 to 15 per cent. of silicon. This carbide is found to be present on rapid solidification of the alloy followed by a quick rate of cooling in the solid state. On annealing, the carbide constituent decomposes with the formation of "fine graphite" and presumably silico-ferrite. The influence of alloying elements upon the stability of the carbide was investigated and found to be similar to the action of the same elements on the cementite in low-silicon iron-carbon alloys. The true identity of the carbide has not been established, but it is shown that it cannot be regarded as pure cementite.

SPRAYED-ON VITREOUS COATING

"Silco," produced by the Mitchell-Bradford Chemical Company, 2446, Main Street, Bridgeport, Conn., is a new sprayed-on vitreous coating, which, it is claimed, resists acids, mild alkalis, rust, corrosion, heat, impact, abrasion, etc., and is a dull finish that may be buffed to an egg-shell gloss. It is dried at 200 deg. F. and baked at 350 deg. in a convection-type oven, or by infra-red lamps, and is produced in black, white, army drab and navy grey colours. It withstands heat up to 1,000 deg. F., is not affected by a 200-hr. salt spray test, and is hard. It is not flexible, though will bend 30 deg. without breaking. The coating thickness is 0.001 to 0.002 in. Surface preparation is done either by sand blasting or alkali cleaning, acid pickling, washing or bonding. A typical job is on gasoline engine exhaust manifolds, mufflers and pipes.

W.P.B. ALUMINIUM AND MAGNESIUM PROGRESS

(*Concluded from page* 346.)

primarily and secondary, does not mean that it is available in adequate quantities in all the required shapes and sizes. An occasional bottleneck still exists. And unbalanced demands create spot bottlenecks—examples: demand for tube blooms, which occupy a lot of time on extrusion presses, reduces the output of extruded shapes; overall rod demand is below total rod-making capacity; production difficulties, including labour and large rejections, prevent castings output from reaching capacity levels, especially in permanent moulds; while demand for small hammer forgings exceeds current output of facilities (not fully manned due to labour shortages), although capacity is available in press forgings.

To overcome these bottlenecks, capacity is being expanded for forgings and extrusions, and attempts are being made to lower specifications for certain types of castings.

W.P.B. ALUMINIUM AND MAGNESIUM PROGRESS

RAPID ADVANCE IN OUTPUT

An account of America's successful effort to provide sufficient aluminium and magnesium for tanks, planes and other war needs was recently given by Arthur H. Bunker, Director of the Aluminium and Magnesium Division of the War Production Board. In 1940 America was producing a limited amount of aluminium and practically no magnesium, Mr. Bunker said. Most of the aluminium alloys were of such soft texture they were wholly unsuited to war uses. Few processing plants were capable of processing hard war alloys.

A very heavy aircraft production programme, following Pearl Harbour, confronted the light metals industry with problems that appeared insoluble. Additional imports of bauxite had to be obtained despite U-boats. Over-all requirements in the aircraft programme for aluminium, needed in many forms, and magnesium, used both as an alloying material and in the form of special shapes, primarily for engines, were stupendous. Day-to-day fluctuations in requirements and specifications placed an additional strain on already over-burdened processing facilities. Vast quantities of magnesium also were required for incendiary bombs.

Because of the wartime demands for stronger alloys the American aluminium industry had to discard its peacetime fabricating machinery and begin extensive building of new plants. Development of fabricating facilities was done at a cost of more than a 1,000 million dollars, 80 per cent. of which was supplied by the government. Some idea of the result of this development may be obtained from the estimated 1943 output, as compared to that of 1939: Domestic bauxite, 12 times increased; aluminium tubing, 13; aluminium sheets, 7; aluminium rod and wire, 12; extruded shapes, 10; aluminium forgings, 45 times increased.

Vast amounts of raw materials were required. Chief among them were 200,000 tons of petroleum coke a year, almost 500,000 tons of soda ash, 60,000 tons of sulphuric acid, 1,500,000 yds. of filter cloth. Aluminium and magnesium reduction industries used 30,000,000,000 kw.-hrs. of electricity a year.

The labour supply all along the line became pitifully inadequate for the demands put upon it. Labour had to be found, and with a few exceptions was found, to man the pitlines and facilities. From a total of 30,000 employees in 1939; the labour forces in the light metals industry has grown to an estimated 200,000 in March, 1944. The expansion demanded many adjustments, and large numbers of women are now doing work formerly done only by men. The man-power shortage is still acute, and despite the fact that progress has been made, it is currently the No. 1 problem before the industry.

Secondary Metal

Not all the light metals used in aircraft and other essential production are turned out in primary reduction plants in this country. Contracts with the Aluminum Company of Canada gave 250,000 short tons of aluminium up to September 1, 1943. Consumers and fabricators of light metals were educated to segregate the alloys and return them for smelting. This source will soon net the industry 350,000 tons of aluminium a year—twice the total pre-war primary production of aluminium. Salvaging this aluminium also saves the critical alloy components such as copper, manganese, etc.

Invention and innovations also played their part in the story of aluminium and magnesium. A novel method of magnesium reduction (using ferro-silicon as a reduction agent) saving power and critical materials was developed by American industry in co-operation with Canada. New processes for utilisation of low grade bauxite and other low grade aluminium ores were developed in order to save from exhaustion native high-grade deposits.

Because of the improved supply-demand picture, it has been possible: (1) to move Russia's fourth quarter aluminium allotment into the third quarter, and (2) to divert to Great Britain 90,000 tons of Canadian aluminium scheduled to be shipped in 1944. Aluminium supply is forging progressively ahead of allotments, as shown in Table I.

TABLE I.

1943.	Total Supply. (millions of lbs.)	Allotments.
1st quarter ...	582.1	534.8
2nd quarter...	633.4	585.5
3rd quarter...	790.4	661.6
4th quarter...	871.2	774.0
Total ...	2,877.1	2,555.9

The aluminium division has encouraged the Army and Navy to expand their uses of secondary aluminium in items such as gun director parts, in which substitute materials had formerly been used; the steel industry has been permitted to use increased quantities of secondary aluminium for deoxidising; Russia has agreed to accept one-third of its fourth quarter requirements in secondary, instead of 100 per cent. primary, aluminium; and a programme is being pushed to eliminate specifications calling for primary metal when secondary would do.

Scrap Products

Results are already apparent in the swifter flow of scrap. Moreover, it is likely that the oversupply of scrap in fabricators' and dealers' hands, amounting to 5,000 tons, will be dissipated within 60 days. But here again labour shortages have hampered scrap processing by smelters. A big factor in the W.P.A. aluminium division's re-education drive has been the policy of scrap segregation; about 90 per cent. the scrap currently being marketed is segregated, as against 30 per cent. two years ago.

The fact that there now is enough aluminium, both

(*Continued on page* 345.)

QUALITY OF CASTINGS BEGINS IN THE FOUNDRY

Every factor in foundry practice determines the final quality of castings and merits the closest consideration and control

By WILLIAM G. REICHERT

(*Continued from page* 328.)

Some Methods Used to Obtain Directional Solidification of Metals

Several of the more important methods used to obtain solid quality castings are enumerated below:—

(1) *Gating System.*—Gates, the actual points at which molten metal enters the mould, often provide an excellent means for directing solidification. Of the three fundamental classes of gates (top, parting, and bottom), only the first two are capable of producing favourable temperature gradients. This they do by virtue of their elevated location. All other things remaining equal, the portions of the casting farthest away from the gate will freeze first, and that freezing will tend to be directed from this farthermost position towards the gate. Thus a gate situated at or near the top of the casting will direct solidification up to itself, while a gate situated at the bottom of the casting will direct solidification down to itself. The direction of the latter is counter to that required for efficient feeding. Bottom-gating, despite the adverse temperature gradients it creates, enjoys the greater popularity among foundrymen. It is regarded as being the orthodox method for gating castings. The reason for its widespread popularity is its ability to introduce metal into the mould with a minimum of metal and mould disturbance.

(2) *Riser Pouring.*—Two well-approved methods for obtaining sound castings are:—(*a*) Direct riser pouring; and (*b*) indirect riser pouring. In direct riser pouring the casting is poured directly through the riser, while in other cases the metal is poured through a sprue which enters the riser before it enters the mould cavity. Directional solidification of the casting from the bottom of the mould to the top is assured by the cooling of the first metal to enter the mould and directed to the riser at the top. Two advantages are shown:—(1) Economy in yield; and (2) lower pouring temperatures. In indirect riser pouring the solidification of the metal is also directed to the riser. To obtain directional solidification the mould may be placed either horizontal or at an incline—it may also be rocked. After pouring, this type of gating does not play such havoc with the mould materials.

(3) *Total and Partial Reversal Pouring.*—Wherever flat surfaces are obtained, the mould is usually tilted or it may be tilted and reversed to obtain directional solidification. In gating castings of this type the riser size can be reduced to some extent. The method often requires special rigging equipment. Unfortunately, the reversal systems are not applicable to all manner and sizes of castings, and their range of usefulness has been limited. Large moulds containing from 4 to 12 tons of liquid steel cannot be easily reversed with promptness and safety, but this does not preclude the use of the principle of controlled directional solidification on large castings. Favourable temperature gradients can be imposed upon them.

(4) *Padding.*—For large castings it is the usual procedure, wherever possible, to pad the mould in order to obtain proper solidification. However, this will increase the finishing cost. In certain types of castings a persistent shrink was always found. The substitution of external pads for external chills aided greatly in the production of sound castings.

(5) *Step Gating.*—Step gating is often resorted to in the pouring of large cylinder-type castings to obtain directional solidification and eliminate sponginess, which is often the case when all the metal runs through the bottom and is forced to the top of the mould.

(6) *Blind Risering (Williams Riser) and the Influence of Atmospheric Pressure.*—Another method of risering castings is to place a refractory material or core in a blind riser so that atmospheric pressure is always acting upon the liquid metal in the centre of the riser. There are certain advantages of this method:—(1) It allows a minimum of mould erosion; (2) frequently this type of risering can be more readily located in the mould with respect to the section to be fed; and (3) it often affords an increased yield.

(7) *Knife Gating.*—This method of gating is not relatively new, but does possess some excellent advantages, particularly in the casting of flat plates. This type of gating is generally poured downhill or vertical.

Miscellaneous

Belief in the necessity of a riser in every mould still persists, but mass-production methods have helped to explode that thought. In grey iron, risers can be reduced to a minimum, and very often eliminated, by properly controlling the flow of metal through the gating arrangement. In one foundry melting over 500 tons of iron not a single ounce of it goes into a riser. That is merely offered to show what systematic co-ordination all along the line, that is, design, pouring, temperature, composition and gating can accomplish.

Individual problems in shrinkage very often must be solved by a given set of circumstances which surround the casting; for example, a casting can be recalled in regular production made with soft iron having an abrupt change in section ¾ to 2½ in. Solidity was essential in this heavy section, because a lubricated shaft was placed through that section. If shrinkage occurred, it would collect chips in machining and under

The Quality of Castings

forced lubrication would not only cause excessive wear on the shaft, but would impair the lubrication to other parts of the machine.

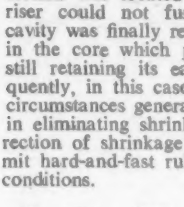
The gating arrangement could not be changed because of flask equipment; the composition of the iron could not reasonably be changed because of machining speeds set by the engineering department—neither could the design be changed. Furthermore, this heavy section was located in an inaccessible place where a riser could not function properly. The shrinkage cavity was finally remedied by a localised chill placed in the core which produced a closer grain iron, but still retaining its easily machining qualities. Consequently, in this case, as in many others, the force of circumstances generally dictate the method to be used in eliminating shrinkage cavities. Obviously, the correction of shrinkage problems is too complex to permit hard-and-fast rules to cover all circumstances and conditions.

Slag and Dirt

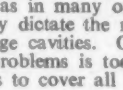
Entrained slag in the metal also requires attention if perfect castings are to be produced. It is often observed when the heats are quite cold that considerable slag accumulates in the ladle, which is rather difficult to remove. Metal of this kind, when poured into castings, shows aggregates of slag. To overcome a slag condition of this kind it is necessary to restrict or choke the flow of metal at some point in the gating system, so that the downgate can be kept full during the pouring operation. It may also be remedied by placing a slag or dirt catcher to restrict the flow of metal between the sprue and the mould cavity. These are only precautionary measures—the real solution, however, is properly to melt the iron, which will readily clear itself of slag without much difficulty.

Rigging Practice

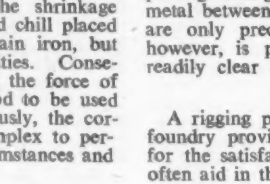
A rigging practice file should be maintained by the foundry providing a record of information necessary for the satisfactory reproduction of castings and will often aid in the production of quality casting. It func-



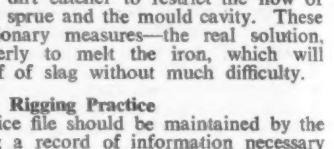
STEP-GATING.



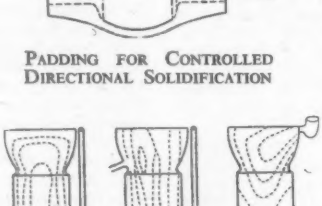
DIRECT RISER POURING



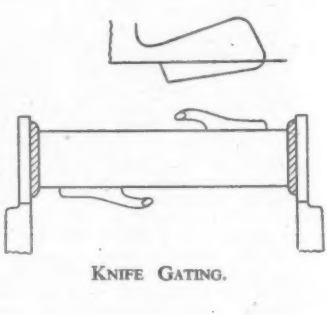
PADDING FOR CONTROLLED DIRECTIONAL SOLIDIFICATION



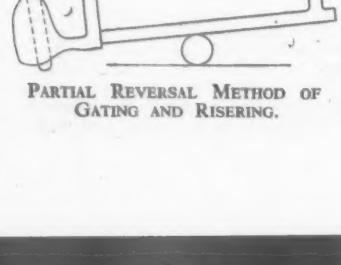
ATMOSPHERIC PRESSURE FEEDING.



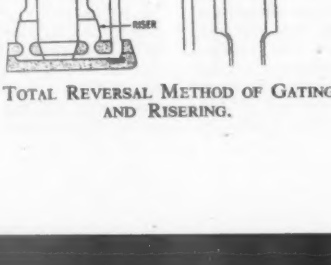
EFFECT OF TOP AND BOTTOM GATING ON TEMPERATURE DIFFERENTIAL.



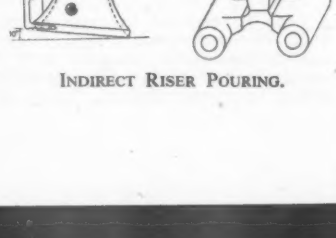
KNIFE GATING.



PARTIAL REVERSAL METHOD OF GATING AND RISERING.



TOTAL REVERSAL METHOD OF GATING AND RISERING.



INDIRECT RISER POURING.

tions also as a reference for the gating of new castings and as a check to ensure the complete inspection of pilot castings.

This should include:—(1) Floor location in foundry, type of sand; (2) overall dimensions of casting; (3) section thickness; (4) location of ingates, whether hand-cut, loose pieces or mounted with pattern; (5) area of ingates at casting, location of choke; (6) location and size of downsprue; (7) location and type of any dirt skim devices, as dam gates, skim cores, etc.; (8) location and size (including height) of risers; (9) area of riser-pad and distance of riser from casting; (10) location of chills, if any; type of chill coating; (11) size and type of flask; and (12) special details, as pouring on downhill slope, use of carbon cores, the nailing of copes for added strength or the use of special sand for the same purpose, the use of shrinkage relief blocks (as in pipe castings), location of metal inserts or bushings, etc.

Melting Operations

The responsibilities of melting and moulding often overlap and, unless there is a mutual appreciation of this fact, it may be the prime cause of failure to produce the best quality most economically. Unless those responsible for the quality of the product and the economy of the melting process have complete supervisory authority, either the quality of the product will fail to meet specifications or the costs of production will increase.

Careful and consistent melting operations must be practised, otherwise the value of composition and specifications are negligible. The entire foundry industry has now become aware that the only method to produce high-quality castings is to insist on precise control of all melting operations. To-day cast iron can be made of approximately 100,000 lbs. tensile when heat-treated and 70,000 lbs. as cast. However, merely writing specifications for analysis will not produce this type of iron, nor can it be produced on a very highly competitive price basis alone.

Design—Preparation and Raw Materials

The first consideration in the melting of quality metals is the design and preparation of the furnace, whether it be an electric, open-hearth, cupola, or air furnace. In considering the design of a cupola, attention should be centred on the depth of the crucible, tuyeres, height between tuyeres and charging door, location of tap and slag hole, capacity of the furnace and the capacity of the blower. Careful thought should be given to the quality of the brick for the various parts of the furnace and the method of lining. After use the slag should be chipped off and the patching material rammed properly. To maintain a quality product the raw materials must be of suitable quality, such as the fuel, flux and iron and steel mixtures.

Melting Operation

Because of the vast number of cupola furnaces installed, it is proposed to follow this method of melting to determine how these operations affect the quality of the metal. There are a number of cupola operating factors which regulate the quality of the metal from the weighing of the charges to the shake-out of the castings.

(1) The method of charging the furnace, the weight, type and sequence of charges, as well as iron and steel, coke and limestone, are important.

(2) The metal mixture should be of uniform size. Small sections and small pieces produce oxidised metal, while large thick sections produce cold metal. Therefore, the size of the metal section, the size of the metal charge, coke and limestone should be maintained within limits.

(3) The bed coke should be measured by volume and the coke added between charges by weight. The important features here are the height, placement and ignition of the bed and soaking time. The height of the bed naturally depends on the pressure and the velocity of gases which pass through the cupola.

(4) A constant melting zone is essential—this is influenced by the pressure and volume of the blast used.

(5) Proper fluxing using a slightly basic slag, together with hot melting, will reduce the sulphur. For some types of castings and operations a desulphurisation of the iron is required.

(6) The quantity and pressure of the air delivered to the cupola are important factors in the production of quality iron. An air meter or weighing device to control the air delivered to the cupola is necessary. Some idea of the air blown through the cupola in the melting of 100 tons of iron with a coke ratio of 9 to 1 follows:—200,000 lbs. of iron, 22,000 lbs. of coke, 6,000 lbs. of limestone, 2,500,000 cub. ft. of air, 0.0765 lb. per cub. ft., 191,250 lb. The weight of air which enters the cupola should be weighed. A difference in temperature from 32 deg. F. to 100 deg. F. will show a difference in volume of 20 per cent., and from 29.5 to 31.5 barometric pressure will show a difference of 3.3 per cent. in the volume of the blast.

(7) A wedge test is an important control of cupola irons under immediate operating conditions.

(8) The burning rate of the coke which controls the melting rate of the iron with the proper addition of air are definitely important factors to be considered.

(9) For different types of work in operations, many require the cupola to be slagged differently. For some cupola operations it is advisable to install a front slagger, a forehearth or mixing ladle.

(10) The type of scrap is an important consideration.

Improper attention to these factors will definitely produce oxidising conditions, variations in temperature, defective castings, and will ruin the physical properties of the metal.

Carbon Structure and Control

The form which carbon (combined or graphitic) occurs in the iron is regulated not only by the quantity of steel added to the cupola, but also by the pouring temperature of the metal and alloy additions. A high temperature will increase the tensile strength of the iron as much as 10 per cent. by slight changes in the form of the graphite. The total carbon can be regulated largely by the percentage of steel in the

The Quality of Castings

mixture and to a lesser degree by allowing the metal to remain for a longer time in the well of the crucible in contact with the coke.

Another factor involved in cupola combustion is the reactivity of the coke; the amount of CO formed will vary somewhat, especially where the physical character of the coke varies, other conditions remaining constant. Soft, easily burnt varieties produce more CO than the hard, less easily burnt varieties. The character of the coke also influences the total carbon of the metal as well as the structure and physical properties of the metal. The total carbon, its amount and structure, are important in obtaining results in producing a quality and uniform iron. In order to control cupola carbons, it is necessary first to have a suitable charge, then use a suitable coke, then employ a suitable melting technique, and finally a suitable tapping technique.

Pouring Practice

The quality of the product is often dependent on the proper pouring temperature, especially in the manufacture of castings for high physical properties. The desired pouring temperature for iron of high physical strengths is above 1,455 deg. C., the lower pouring temperatures will result in lower physical properties. It is possible to obtain strengths as high as 31 tons per sq. in. and as low as 22 tons per sq. in. from the same metal poured from the same ladle, but at different pouring temperatures. The one objection of the foundry pouring castings hot is the fact that the moulding sand will not withstand that temperature. The answer is to produce a moulding sand that will stand these high temperatures. Pouring hot is essential, whether the casting be large or small, thick or thin, if the best work is to be produced. Very often lack of density in a casting is due to pouring at a low temperature, resulting in blow or slag holes.

To control pouring operations it should be seen that the moulds and the pouring off of these moulds is properly organised, so that frequent shut-downs in the cupola are avoided. The ladle should be clean, properly dried and hot. A definite programme should be established to determine the method of handling the metal. Sufficient time should be taken to set the ladle properly at the pouring basin. The empty ladles should be returned to the cupola quickly to retain ladle temperature and avoid shut-downs. Splashing against the basin should be guarded against; also, the basin should be filled quickly, but not to overflowing. It is also important to maintain the metal in the basin at a sufficient depth in order to maintain a full sprue at all times. The ladle lips should be kept clean. All these items tend to produce defects and the correction of these will improve the quality of the iron.

Cupola Developments

New developments have shown that by heat-treating an alloy cast iron, strengths approximating 44 tons per sq. in. can be produced. However, unless all of the technique in foundry practice are satisfied, it is very often possible that a 13-ton iron will produce more satisfactory results in operation than a 44-ton iron, especially if the higher strength iron contains defects such as blow-holes, shrinks, dirt inclusions and defects of a similar nature.

Moisture in Air Blast

Certain foundries are known to control the moisture content of the air blast to attain a more uniform product, and others to preheat the air blast by means of waste-heat regenerators to secure fuel economy. It has been the experience of many foundrymen that for certain types of very thin castings, particularly piston rings, it had frequently been necessary to reject castings produced during very humid weather due to excessive hardness (chill effect in edges of the rim opposite the gate). The rejected castings were higher in combined carbon, but lower in total carbon than those produced in dry weather. The trouble was usually encountered after the cupola had been in operation approximately 1 and 1½ hrs., and the first remedy was to increase the holding time of the metal in the well of the cupola with the blast off, or to increase the amount of coke per charge. Both methods tended to increase the total carbon. However, the trouble was eliminated by the installation of a refrigerating system to reduce the moisture in the blast.

In order to show the effect of moisture upon the melting conditions, let us remember that a cupola melting 100 tons of iron per day will use approximately 2,500.000 cub. ft. of air. The water content of the air will vary between 2 and 12 grains per cub. ft. from a very dry air to a very wet air. Therefore the amount of water drawn into the cupola during the melting of 100 tons of iron may be as low as 7 cwts. or as much as 2 tons. The advantages of dry air blast is well recognised by blast-furnace operators, from advantages of fuel economy, increased iron production and uniform quality.

Chill is dependent upon the composition of the iron and, in turn, this is affected by the moisture content of the air. It has been shown that an increase in the moisture content of the air blast caused a decrease in metal temperature and melting rate, and an increase in the manganese and silicon losses. This indicates oxidation. Lower carbon contents were obtained with high moisture air. Chill was increased with a decrease in carbon and silicon contents.

Preheated Air

Another method of improving the cupola operation is to preheat the air. In the use of preheated air the metallurgical losses of silicon and manganese were reduced considerably and the substitution of hot air for cold air also reduced the cooling effect on both metal and slag, so that it is possible to tap hotter metal and operate the cupola for a longer period of time when using preheated air. It has been shown that preheating the air blast to 480 deg. C. resulted in an increase in the tapping temperatures of 55 to 80 deg. C., increased the melting rate, decreased the

silicon and manganese losses and allowed a reduction in coke consumption of about 20 per cent. Preheating the air had no individual effect on the properties except as higher temperatures affect cast iron.

Very often it is said that the above accessories for cupola operation are unnecessary. In many cases this is true, but to produce certain types of quality casting economically and to obtain uniformity through variable atmospheric conditions these regulations for control are often essential. The casting which an individual manufacturer produced may not be sufficiently sensitive to detect these qualities. Consider the manufacture of piston rings—a very light section—and the manufacture of a machine-tool base, a very heavy section—these are entirely two different conditions in so far as the machinability of the castings are concerned. It is the general opinion that any piece of equipment that will eliminate a variable from cupola practice stands an excellent opportunity to make good for certain types of castings.

Shakeout Heat-treating and Cleaning Operation

The shakeout, heat-treating, and cleaning operations must be carefully considered if quality castings are to be produced. More castings warp by shaking out than in any other way. A careful study should be made of all stripping and shaking-out procedure. Shaking out castings too quickly may cause warpage and hard edges. Castings should be processed with precision in the heat-treating operations if quality castings are to be produced. Proper cleaning of the castings is essential. Sand retained on the casting often increases machining difficulties and may seriously impair tool life and production schedules.

Management

The extent of the effect of the human element in producing quality castings will vary according to the procedure adopted. In large production foundries, where the castings are of a repetitive nature and are generally mechanised to a considerable degree, the effect of the human element is reduced. In foundries of this kind the operator has only a few operations to perform. Unfortunately, however, a very large volume of castings is produced in jobbing foundries. This general type of work often calls for individual experience and skill in many of the operations, and here the human factor will have a decided influence on the quality of the casting produced.

This condition emphasises the basic need of the industry for apprentice training courses. Apprentice training is definitely a function of management. Although the industry has in a large measure been rapidly mechanised within the past 15 years, a means must not only be provided to train the needed skilled workers, but also to train the men required to operate and supervise the foundries. A programme of this nature must first consider a policy of:—(1) The selection of the men; and (2) the type of training course—(*a*) class training, and (*b*) foundry training.

One of the greatest advantages of the apprentice training plan is the placement of men in supervisory capacities. Very often experienced men leaving the employ of the company are difficult to replace immediately. The young man who has had the required training may well accept this job with some confidence and assurance of success. There may be some difficulty in securing satisfactory apprentices in foundries located in Metropolitan areas. To counteract this condition all apprentice courses require good will and co-operation among the boys and a similar interest on the part of the management. It has been suggested that an organised apprentice club may often be the solution to this problem.

Good Housekeeping

Not long ago little attention was paid to what is now termed as good housekeeping methods. Irritating and toxic gases and fumes, particularly those of lead and zinc, often seriously affected the workers. At present the average establishment, where but comparatively few men are employed, is in many instances housed in buildings erected for the purpose where adequate lighting is used and in general good ventilation is provided. This is done to provide a healthful foundry atmosphere.

Not only has good housekeeping methods proved of definite benefit in reducing accidents and improving the health of the worker, but it has in many cases stimulated the morale of the employee who is desirous of a clean and safe place in which to work. The time and money spent in maintaining a clean plant has proven a profitable investment in producing quality castings, even though the casting may be classed as an intangible. It might also be mentioned that at present every foundry organisation is giving serious consideration to the prevention of occupational diseases and to control of industrial accidents. Also, many foundries, both large and small, have planned safety organisations sponsored by the management. All this indirectly affects the quality of the castings produced.

Records—Inspections and Supervisions

Records are of major importance in order to present the facts in any foundry, and a permanent record of all test data should be kept for reference so that casting losses may be constantly checked even after they have been despatched to the machine shop. A complete, clear and concise set of records of each day's operations, correctly compiled, and properly interpreted, should be required.

Inspection should not be considered merely as a means for accepting and rejecting individual lots of castings, but also as a means for making adjustments in the process itself. It is true the inspection must serve the immediate purpose of disposing of the product at hand, but it can also serve as a basis for action on the process with a view to regulating the quality of the future product. Proper supervision of the work is extremely important. It should be recognised that the fundamental law of management—centralised responsibility and authority—are important and have a tremendous influence on the production of quality castings. On the other hand, the proper co-operation between operators and management must

(*Concluded on page* 354.)

DIE-CAST CHUCK JAWS

Cast metal chuck jaws to hold odd-shaped parts for machining operations have been used at various times by most American shops. Usually they are made of brass, bronze or cast iron, and generally a certain amount of cavity finishing with highly skilled labour is necessary to make them usable. Users of jaws cast in lead, babbitt or fusible alloy have found them limited for high production because of the lack of durability, states H. F. Lenz, of American Screw Products, in "Iron Age."

Over a long period of time, American Screw Products in the manufacture of forged hydraulic fittings, followed the common practice of machining the jaws out of steel. The procedure was naturally slow, expensive and efficient only with skilled labour. In an effort to comply with the War Production Board's request for greater production, experiments were made with a commercial type of fusible alloy cast around the forging and subsequently separated into two parts or jaws. The need of harder and more durable material led to the development of jaws cast from Kirksite "A," a zinc-base alloy widely used for drop hammer dies in the aircraft industry.

The system of making these jaws on a production basis has revolutionised the machining of these forgings in this plant. The value of the system lies in its universal adaptation to the various types of clamping fixtures, chucks, oversize collets and vices used on such machines as multiple-spindle automatic chucking machines, wire-feed screw machines, turret lathes and drill vices.

Two sizes of jaws, 2¼ and 4 in. o.d., accommodate practically all of the hydraulic fitting forgings processed. Made in sets of five pairs they can be used on automatic chucking machines for long runs. If a short run is needed, any set can be mounted on two-jawed air-chucks, Barker wrenchless chucks, or on special over-size collets of American Screw Products design. If a drill-press operation is needed the jaws are mounted in an air-operated vice.

A "beginners" class of labour can be used on all operations, and a pair of jaws can be completed in 50 min. With division of labour, a set of five pairs of jaws can be made in approximately 3 hrs.

Details of Process

Essentially, the process consists of casting the Kirksite alloy in a die fitted about a sample forging blank which has been machined at one end. This leaves a solid, cylindrical chuck body with the machined end of the forging protruding. It provides a finished surface for chucking the assembly while turning and facing the Kirksite body. In some designs the body must be milled out to fit the jaws of a two-jaw air chuck or special false jaws. In another design, four holes are drilled and tapped in the end of the body for ¼ in. socket head screws for adaptation for oversize collets. The slug is then sawed in halves. The split parts of the sample forging are knocked out, the halves are marked, and after being taped together are sent to the tool crib in suitable wood containers.

The impression-cast jaws can be mounted very quickly and the forging will run true. This makes possible a machining allowance on the forging of only $\frac{1}{16}$ in. on the diameter instead of the not uncommon allowance of $\frac{3}{32}$ or $\frac{1}{8}$ in. A set of Kirksite jaws is good for 8,000 to 10,000 operations without loss of accuracy. Rapid and economical jaw replacement makes this process a marked advance in shop practice.

American Screw Products is now experimenting with a design of mould which will cast the jaws completely cored, slotted and sized so that splitting into halves will be about the only operation necessary to prepare the jaws for use.

Research in India

Industrial research in India is essentially a wartime development, being less than three years old, and, even within this small period and with scanty financial resources, it has been able to make a mark, owing to the energy of Sir S. S. Bhatnagar, Director of the Board of Industrial and Scientific Research. The Board has already successfully investigated a number of schemes. It has prepared schemes for a national physical laboratory and a national metallurgical research laboratory. Special committees are investigating schemes for a national chemical laboratory, and for a central glass and silicate research institute. On the recommendation of the Board, sanction has been given to some new research schemes, including the development of Si-Cu bronze, preparation of gelatine, and the development of powder metallurgy for the manufacture of self-lubricated bearings and composite metal graphite brushes.

U.S. Electric Furnace Capacity

Of the 344 steel foundries in the United States, 276 are equipped with a total of 508 electric furnaces. These figures were given by Mr. R. L. Baldwin at the annual conference of the Electric Furnace Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers at Pittsburgh recently. The existing 68 electric steel plants, he stated, have a total of 201 electric furnaces, ranging from ¼-ton to 80 tons capacity. These have a combined holding capacity of 4,500 tons, compared with 1,145 tons as at January 1, 1940, or an increase of 293 per cent. in 3¼ years. At present the United States electric steel industry has an annual capacity of 6,100,000 tons. More furnaces are being installed and a further rise in active capacity will be recorded in 1944.

Spectrographic Analysis.—The Harry W. Dietert Company, of 9330, Roselawn Avenue, Detroit, Michigan, U.S.A., is publishing a small bi-monthly paper of interest to spectrographers and spectrographic laboratory personnel. The purpose of the paper is to disseminate technical information on spectrographic analyses and to acquaint interested personnel with latest developments. Readers wishing to have their names placed on the mailing list should write to Mr. Herbert Schulze at the above address, when copies will be sent free of charge as published.

HEAVY CASTINGS IN GREEN SAND*

By H. ABNETT

During the course of twenty-three years in Africa, the author has been impressed by the enormous amount of casting which is done in dry sand, and, bearing in mind the period we are passing through, seeking to capture markets for numerous articles which were never made here before, it appears to him, as a layman, or in other words, just a man from the foundry floor, that if, after the war, when foundries overseas are again keenly competing to recapture part at least of what they have lost, South Africa is to retain these markets here, then serious attention must be paid to doing away with a considerable amount of this dry sand moulding and turning the work out in the way that it would be done by European competitors; with its consequent saving in overhead.

Road Roller Casting

The example chosen is the rear driving wheel of an Aveling and Porter steam road roller. The outside diameter of the casting is 6 ft. 6 in., inside diameter 6 ft., and the tread 15 in., and the approximate weight of the casting 1½ tons.

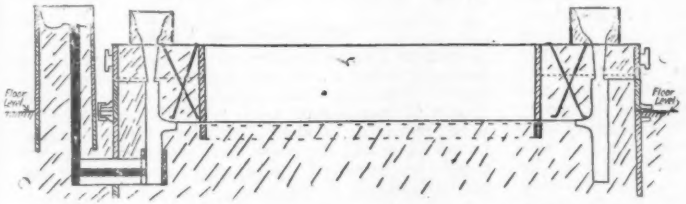


FIG. 1.—SECTION OF MOULD FOR CAST-IRON ROAD ROLLER WHEEL.

From Fig. 1, which shows the mould, it will be noticed that the greater part of the drag is in the foundry floor, and, being a repetition job, this box was never moved. After cleaning out from the previous day's cast, the inside of the drag was peg rammed as hard as possible a little deeper than the depth of the mould.

A layer of prepared facing sand was then placed all round, and the pattern, which was of cast iron, lowered on to this and hammered down with a cast-iron hammer to the level of the top of the drag.

Before proceeding with any further ramming, three loam cakes, which had previously been rubbed to the inside and outside shape of the wheel, and the runner core, were placed in position, the runner core passing through a square hole in the drag.

Three inches of facing sand was placed all round the outside of the pattern to a depth of about 6 in., backed with floor sand and thoroughly peg-rammed and finished with the flat rammer, this proceeding in layers to the top of the pattern, with the exception that after reaching a distance about half-way up the pattern the flat ramming was dispensed with.

The inside of the wheel was rammed in a similar manner, to the level of the strengthening piece which carried the spokes. A cast-iron ring, ¼ in. thick and about 6 in. deep, was bedded just below the joint level, this ring serving the double purpose of preventing a break through when casting and allowing the moulder to move around safely when finishing the mould.

The inside and outside joints were made in the usual way and the top box placed in position. The actual sand-carrying portion of the cope was just sufficient to carry the hanging portion of the mould with safety in casting, and the inside diameter of the cope was just about the same as that of the ring buried in the bottom half of the mould.

Multiple Risers

Eight riser pegs were spaced round the pattern; four of these were used for rod feeding purposes, and the other four to guard against strain during casting. The hanging portion was hooked with cast-iron hooks and the whole of the hanging portion rammed with facing sand, the remainder of the cope being rammed with floor sand. After scraping off surplus sand and flat ramming, the cope was thoroughly vented all round with a ¼ in. diameter wire.

The cope was lifted off in the usual way by the aid of slings on two trunnions, but before the box was turned over for finishing, a belt about 4 in. in width was buckled right round the hanging portion, to prevent this heavy mass of sand from starting as the box went over. The drag was also freely vented with the ¼ in. diameter wire, both inside and outside, and the pattern hammered all round with the cast-iron hammer and shaken by the lifting chains as it was drawn out by the crane.

Mould Finishing

In finishing the mould, 3-in. sprigs were used only on the filleted portions of the top and bottom, and after repairing any broken parts of the mould, before dusting with plumbago, the moulder removed the glossy finish on the facing sand by wiping the palm of his hand over the whole surface. Before swinging the cope over to close the mould, the belt was again buckled in position, and, after closing, no weights were used, the top and bottom boxes being simply held together by clamps and wedges on the lugs. The pouring basin and downgate were entirely outside the moulding boxes.

The downgate, which was of square section, was placed up against the projecting end of the runner core and rammed in boxes built up to the required height, which was just above that of the riser bushes.

* A Paper read before the South African Branch of the Institute of British Foundrymen.

Heavy Casting in Green Sand

Before removing the downgate it was hammered down for 2 or 3 in. to form a well to take the first drop of the column of metal in casting. The runner core was rammed with pure Erith sand, and the runner through its centre was 2 in. in diameter.

A loam cake was placed right opposite to the runner, and two more were built around it, the object of these loam cakes being to withstand the inrush of the metal and the backwash in the immediate vicinity of the runner. These loam cakes, which were rubbed to the inside and outside shapes of the pattern, were painted with linseed oil and plumbago, and, together with the runner core, were the only parts of the mould which were dried.

This casting had to stand up to considerable wear on the tread, and also a good deal of shock when doing its job of rolling roads, especially when the scarifier, which was attached to the rear of the completed road roller, was in action, ploughing up old roads. For these reasons care had to be exercised in the type of metal used for casting, which was a good close-grained mixture of pig-iron and machinery scrap.

In the event of the metal being too hot for pouring on arrival at the mould, it was cooled by the addition of runners and risers from other jobs, and the ladle was rotated to keep the metal on the move, which also assisted in cooling. About two hours after the casting had solidified, the cope was removed, also the part of the drag above the floor level, and the sand on the outside of the casting in the remaining portion of the drag was dug out. This left the whole of the red hot tread of the wheel exposed to the air, with the consequent chilling effect on the part of the casting which took all the wear when in operation.

The casting was not removed from the floor for two days. The spokes, which were cast in the strengthening part of the casting, are not shown in Fig. 1, but a similar procedure to that adopted in casting sheave wheels in this country was practised with these roller wheels, and the boss in the centre of the wheel was cast on to the other end of the spokes on the following day.

The labour on this job was two journeymen moulders and one labourer, the labourer coming off the job after closing and going on to general casting operations.

The materials used were cast-iron hooks and moulders' sprigs, practically all of which were recovered; facing sand, which was a mixture of Erith sand, floor sand and coal dust in the proportions of four to six to two, the coal dust being the grade usually referred to as medium.

Eliminating Defects

The faults which could have been looked for in a green sand job of this type were: Swelling at the bottom of the mould, scabbing and blowing from the hard ramming given to the first 6 in. or so from the bottom upward, and the steam generated from the moisture content of the green sand. The swelling was undoubtedly avoided by the extraordinary ramming at the bottom, and the damage done to the permeability of the sand by the hard ramming was repaired by the free use of the vent wire.

Scabbing was avoided by being careful, in spite of hard ramming, to keep the rammer away from the face of the pattern, and no doubt the fact that the moulder took the shiny surface off the face of the mould by the simple operation of rubbing the palm of his hand all over was a contributory factor.

Finally a great deal of trouble from scabs and blows was eliminated by the low moisture content in an excellent facing sand, and also the practice of what seems to be a forgotten art the free use of a vent wire.

Aveling and Porter cast five of these wheels every day, and during the thirteen years the author was with the firm he only saw one given an honourable place on the scrap heap. This firm casts the eccentric straps and sheaves, cylinder covers, bushes, and even the fly wheels for their road rollers, all in green sand, and this could be done in a similar way in South Africa.

Facing Sand and Venting

Because a sand is red does not signify that it is a good moulding sand, and many of the troubles in South African foundries could be avoided if some system of analysis of sands could be introduced. It is felt that large numbers of castings, given the correct facing sand and the more free use of the vent wire, could be produced satisfactory and much more economically in green sand.

QUALITY OF CASTINGS BEGINS IN THE FOUNDRY

(*Concluded from page* 351.)

seriously be considered in the production of quality castings, as well as the co-ordination between the various foundry departments.

There are a number of tools which are used by the foundryman, metallurgist, chemist and engineer to improve the quality and maintain casting uniformity from the raw materials to the finished product. Some of these are listed below:—(1) Sand-testing equipment at atmospheric and elevated temperatures; (2) mould-testing equipment; (3) chemical analysis; (4) physical-testing equipment; (5) spectroscope; (6) magnetic testing; (7) X-ray diffraction methods; (8) petrographic microscope; and (9) binocular and metallographic microscope.

Routine Photometric Analysis.—KURT DIETRICH, in "Die Giesserei" of January 8 last, describes laboratory procedure for the rapid routine analysis of non-ferrous alloys by photometric and colorimetric methods, such as copper and nickel, and the estimation of iron, manganese, lead and cadmium in brass and similar alloys and of bismuth in commercial lead.

NEWS IN BRIEF

ELECTROMAGNETS, LIMITED, have moved from 48, High Street, Erdington, into larger offices at Bond Street, Hockley, Birmingham.

AS FROM January 1, 1944, the title of the Brassfounders' Employers' Association becomes The National Brassfoundry Association.

M.B.M. ENGINEERING (KINGSTON), LIMITED, 158, Cambridge Road, Kingston-on-Thames, Surrey, is being wound up under a High Court Order.

A DEPUTATION of the Parliamentary and Scientific Committee, led by Viscount Samuel, was received by Ministers at the House of Commons. It is expected that as a result of the deputation there may be bigger Government grants to universities for research.

THE FOLLOWING NOTICE appears in the "London Gazette":—Mr. Willie Murgatroyd, 5, Walker Place, Windhill, Shipley, ironfounder. Order of adjudication, dated December 23, 1925, annulled; receiving order, dated December 23, 1925, rescinded; petition, filed December 23, 1925, dismissed, it appearing to the Court that all the debts have been paid in full.

STRICTER SCRAP ORDERS have been enforced by the Germans in Belgium. The collection of scrap has been tightened up, and all unused iron and steel must now be handed in. Civilian products, such as stoves, can only be obtained if up to 90 per cent. of the weight of the metal entailed is handed in as scrap, with exemptions in those cases where no scrap can be normally forthcoming.

MISS MINNIE TYZACK and Miss Rose Tyzack have retired from the joint managing directorship of the family business of Joseph Tyzack & Son, Limited, tool manufacturers, Sheffield, after 25 years' service, and have disposed of the business to Isaac Nash & Sons, Limited, of Stourbridge, and Isaac Nash (Belbroughton), Limited, who are retaining the services of the staff and employees. The Sheffield business was established in 1837.

THE FUSION of two small Scottish trade unions—the Brassmoulders and the Associated Iron, Steel and Brass Dressers—into the National Union of Foundry Workers was ratified by the three executive committees in Glasgow on December 20. The amalgamation will come into operation on January 1. All the foundry workers in Scotland are now organised under one head, except the Ironfounding Association in Falkirk, whose members deal specifically with light castings. The two disappearing unions were last century foundations.

A MEMORANDUM on industrial reconstruction issued by the Internal Combustion Engine Manufacturers' Association, states that the provision and supply of raw materials and the credit necessary for their purchase will constitute one of the greatest international problems after the war. It therefore seems that if the passage through the transition period is to be successfully weathered, there must be, both internationally and nationally, controls effective to regulate demand, restrain inflation, check runaway prices, ration raw materials, and moderate exchange fluctuations.

COMPANY RESULTS

(Figures for previous year in brackets)

Broom & Wade—Final dividend of 15%, making 22½% (same).

Aeroplane & Motor Aluminium Castings—Interim dividend of 10%.

Joshua Bigwood & Son—Final dividend of 5% (same), making 10% (same).

Irish Aluminium—Net profit to September 30 last, £3,129 (£3,562); taxation, £1,681; reserve, £500; ordinary dividend of 6½%; forward, £2,712.

Lightalloys—Profit for the year ended June 27, 1943, after depreciation and tax, £37,718 (£39,794); to reserve, £6,000 (£10,000); dividend of 1s. 3d. per share (same); forward, £5,230 (£4,512).

Lake & Elliot—Profit to July 31 last, after tax, £33,387 (£27,764); provision for future tax and contingencies, £30,000 (nil); preference capital redemption reserve, £2,824 (£2,729); final ordinary dividend of 15%, making 20%, less tax, £10,000 (same); forward, after preference dividends, £34,197 (£52,215).

Marshall, Sons & Company—Profit for year to September 30, 1943, £216,551 (£282,846); net profit, £63,306 (£58,147), after depreciation and £140,700 (£212,000) for reserve for income-tax and E.P.T.; final dividend of 10%, making 13¾% (same); to general reserve, £20,000 (same); forward, £78,390 (£70,501).

Hale & Hale (Tipton)—Net trading profit for the year to August 4 last, £22,311 (£21,114); depreciation and obsolescence, £5,983 (£4,444); dividend on the preference shares, £2,750 (same); dividend on the ordinary shares of 10% (7½%), £5,000 (£3,750); general reserve, £2,500 (£10,000); taxation, £7,500 (nil); forward, £9,837 (£11,609).

PERSONAL

MR. ALBERT GORDON has been appointed an additional director of Parkinson & Cowan, Limited, gas apparatus makers. Sir W. S. Haldane has resigned from the board.

COMMANDER SIR CHARLES CRAVEN, BT., R.N., has been appointed deputy chairman of Vickers, Limited, as from January 1 next, following the resignation of Col. J. B. Neilson, D.S.O., from that office. Col. Neilson remains on the board of the company.

MR. K. HEADLAM-MORLEY has resigned from the position of Deputy-Controller of the Chrome Ore, Magnesite and Wolfram Control of the Ministry of Supply, and has accepted another appointment in a consultative capacity with the Iron and Steel Control. He will continue to act as secretary of the Iron and Steel Institute.

Wills

JONES, J. B., a director of Jones & Campbell, Limited, Torwood Foundry, Larbert, and of the Scottish Enamelling Company, Limited £9,406

GRANET, SIR W. G., a former chairman of the London Midland & Scottish Railway Company, and a director of Associated Electrical Industries, Limited, and other companies £54,360

THE FUTURE OF TIN

PLANS FOR POST-WAR MARKETING

The major problem facing the tin industry is to build up an organisation which will create a market sufficiently wide to maintain producers at a reasonable level of activity. This requires a consumption approaching 250,000 tons of tin annually. In financial terms, the pre-war market for, say, £30,000,000 per annum has to be re-established, and over and above this an additional market for upwards of £20,000,000 worth of new tin annually has to be discovered and developed—a selling task of considerable magnitude.

This is the keynote of a recently published report describing a plan worked out by Mr. John Ireland, Director of the Tin Research Institute. It is shown that sales depend on the satisfaction of the ultimate consumer and that, where better service can be given, expanded consumption follows. The proposed scheme will harness to the problem of increasing the usefulness of tin, the full resources of a modern scientific organisation. This will comprise a nucleus of scientists whose fundamental work will be carried to the stage of practical application by research teams working on a semi-industrial scale under the guidance of committees representing each of the principal tin-consuming industries.

Information Bureaux

An important feature is the establishment of information bureaux in all the important tin-consuming centres throughout the world. These bureaux will be staffed by practical experts ready to go into works and put any tin-consuming process into first-class working order in the light of the most recent scientific knowledge. The experience gained in giving this type of service in Great Britain, and on a smaller scale in the U.S.A., has proved that there is a widespread need for it even in these areas where manufacturing technique is highly developed; and in other consuming countries there is even greater scope.

The report explains the proposed post-war organisation in detail, and summarises the technical developments already made in all the main fields of consumption. It gives the technical grounds on which are based the reasons for expecting to restore those uses of tin abandoned or curtailed during the present scarcity. The report also indicates some promising new uses arising out of the Institute's researches, and gives quantitative estimates of the increased sales that may be expected as the result of the new organisation's activities at the end of a ten-year period.

The Cost

The budget recommended for these activities is £300,000 per annum, to cover research, development, world-wide technical service, and full supporting publicity. This sum, although much larger than that with which the present organisation has been working, is much less than is devoted to other metals, it is stated, and is only about 1 per cent. of the gross value of the tin sold annually before the war.

NEW TRADE MARKS

The following applications to register trade marks appear in the "Trade Marks Journal":—

"KUMIUM"—Metals and alloys. I.C.I. METALS, LIMITED, Wexham Road, Slough.

"KUDIUM"—Metals and alloys. I.C.I. METALS, LIMITED, Wexham Road, Slough.

"ABRAFILE"—Files. ABRASIVE TOOLS, LIMITED, 8 and 9, Paddington Street, London, W.1.

"METVIC"—METROPOLITAN-VICKERS ELECTRICAL COMPANY, LIMITED, 1, Kingsway, London, W.C.2.

"CAMTOG"—Metal clamps. SPEED TOOLS, LIMITED, 10-16, Rathbone Street, Oxford Street, London, W.1.

"EKTOS"—Preservatives against rust. EMERGENCY PRODUCTS, LIMITED, Avon House, 356-360, Oxford Street, London, W.1.

"SYLVAN"—Heating and cooking apparatus. FULGORA STOVES, LIMITED, Grand Buildings, Trafalgar Square, London, W.C.2.

"ALBIMOX"—White fused alumina for industrial purposes. THOS. GOLDSWORTHY & SONS, LIMITED, Hulme, Manchester, 15.

"COMET"—Articles of common metal. CHARLES CHURCHILL & COMPANY, LIMITED, Walnut Tree Walk, Kennington, London, S.E.11.

"FRETEX"—Coating compositions, in the nature of paint. IMPERIAL CHEMICAL INDUSTRIES, LIMITED, Wexham Road, Slough, Bucks.

"SPIRAL" (Device)—Centrifugal machines and parts thereof. SHARPLES CENTRIFUGES, LIMITED, "Hillgrove," Woodchester, Stroud, Gloucestershire.

"TARGET" (Device)—Grinding machines; grinding wheels and grinding wheel segments, all being parts of machines. STACEY'S ABRASIVE WHEELS, LIMITED, 78, Artisan View, Sheffield, 8.

"TEDDOL"—Solutions for rendering surfaces water-repellent, being chemical products for use in industry. BRITISH THOMSON-HOUSTON COMPANY, LIMITED, Crown House, Aldwych, London, W.C.2.

"MILFORD REZISTOR"—Metal cutting and metal shearing tools for use in machine tools. THE HENRY G. THOMPSON & SON COMPANY, c/o Rosling M. Hughes, 72 & 74, Cannon Street, London, E.C.4.

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Foundry Industries, 72, Finsbury Pavement, London, E.C.2—£2,000. W. F. Pyatt and R. T. Richardson.

Porter Engineering Company—£7,000. R. A. M. Porter and J. A. White, 3, Endsleigh Gardens, Surbiton, Surrey.

Gardner & Richardson, 30, Georgian House, Bury Street, St. James, London, S.W.—Mechanical and general engineers, etc. £1,000. S. C. Coker.

J. & W. Whittaker (Skipton), Bull Bridge, King Street, Accrington, Lancs—To take over a business of agricultural engineers carried on as "B. H. Wilson & Sons, Limited," at Crosshills and Skipton. £5,000. L. de S. and J. M. Brammall, and N. Carr.

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WEIGHT-LIFTING IN INDUSTRY

Weight-lifting injuries in industry are still too frequent, according to Mr. R. E. Tugman, Safety Officer, I.C.I. (Alkali), Limited, writing in the November/December issue of "Industrial Welfare and Personnel Management." The author goes on to outline means for avoiding these accidents: a medical examination when starting work would eliminate many of those people whose physical condition proved unsuitable for heavy work—especially the hernia cases; far more attention should be paid to mechanical aids to lifting; the weight and bulk of loads should be reduced to reasonable proportions; new employees should always be trained to lift; bad footwear and bad floor conditions should be watched; all weight-lifting accidents should be investigated to find out the cause and to suggest a remedy. Finally, where workpeople are continuously employed on heavy work, every effort must be made to maintain a good standard of general health—too often it is avoidable fatigue that causes the accident. Rest pauses, mid-shift snacks, good meals, good ventilation, and a satisfactory working temperature are obviously desirable.

GALVANISING RESTRICTIONS RELAXED

Some relaxation of the restrictions on galvanising is to be permitted. The Non-Ferrous Metals Control announce that as from January 1 next, zinc will be released for galvanising a number of articles, for which its use had for some time been restricted.

The articles concerned are:—Boiler fillers; hand bowls; dolly tubs; wrought iron and steel tubes and tubulars; wrought and malleable tube fittings; fabricated and manipulated tubes; cisterns and tanks, including sections thereof, but excluding static water tanks; gutters and gutter brackets; ventilators and cowls; milk bottle crates; wire guards for machinery, ventilators, fans, windows, gutters; wire and other baskets and trays; wire panels, grilles, screens and racks, for external work only.

All other restrictions on the galvanising of products continue in force. The tonnage of zinc used or to be used on tubes and tube fittings must be listed separately from other articles on the return when applying to the Control for zinc.

OBITUARY

MR. CHARLES MORRISON, who died on December 12 at his home in Edinburgh, was formerly in business as a metal merchant.

MR. E. LL. ROGERS, managing director of Rogers & Jackson, Limited, engineers and iron and steel stockholders, Wrexham, died recently, aged 64.

MR. THOMAS SCOTT, a director of George Henderson, Limited, Kelso Foundry, died on December 16 at his home in Kelso, after a short illness. He was in his 69th year.

ADAMSON-HORSEHAY ASSOCIATED

Some three years ago the steelworks-equipment interests of Joseph Adamson & Company, Limited, of Hyde, Cheshire, and the Alliance Machine Company, of Alliance, Ohio, U.S.A., were amalgamated, the new company thus formed being the Adamson-Alliance Company, Limited, of 165, Fenchurch Street, London, E.C.3. A further development has now taken place, in the formation of Adamson-Horsehay Associated, Limited, with head office at the same London address.

Adamson-Horsehay Associated, Limited, combines the interests of Joseph Adamson & Company, Limited, and the Horsehay Company, Limited, of Wellington, Salop, in the manufacture of mechanically-operated structures of all types, turntables, dock cranes, bridges, heavy steelworks' supporting structures for cranes, strippers, chargers, etc.

Both Joseph Adamson & Company, Limited, and the Horsehay Company, Limited, are old-established engineering concerns.

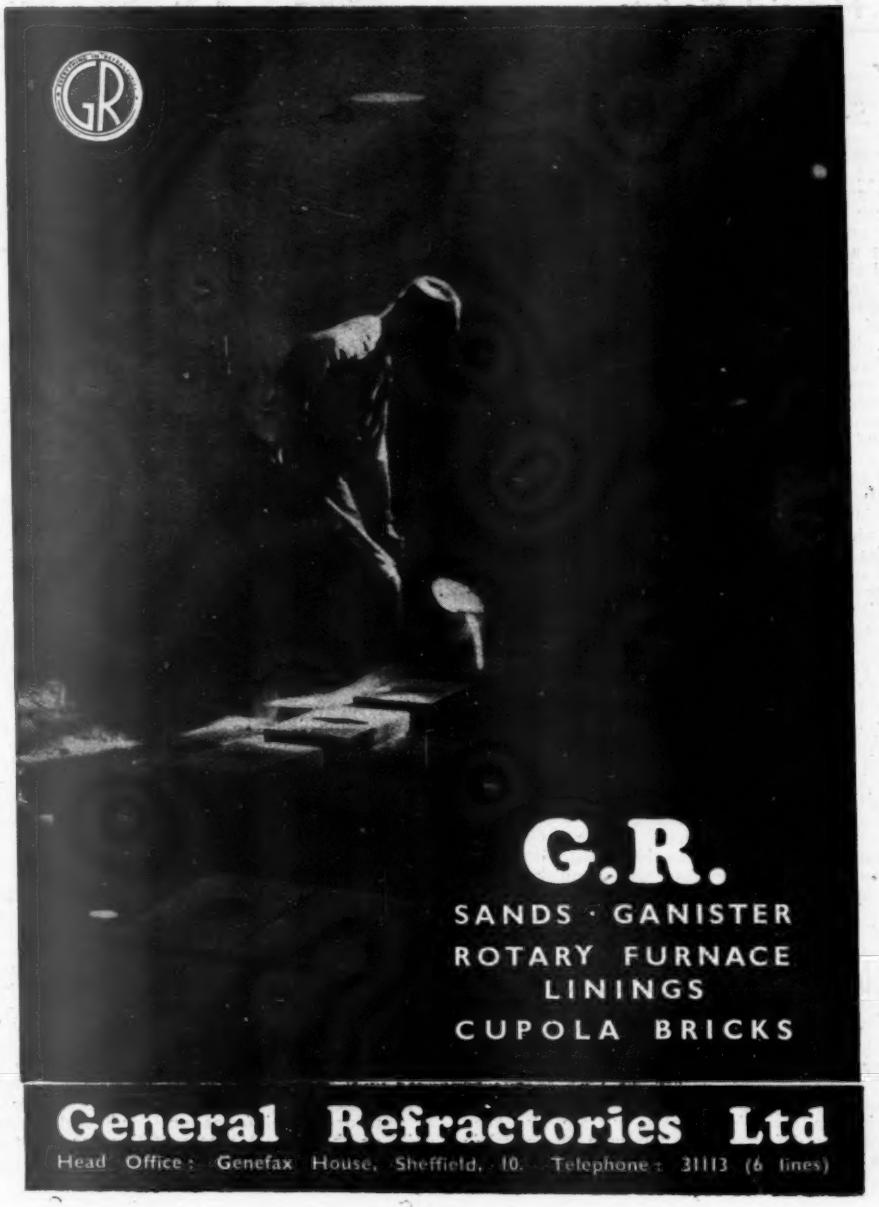
NATIONAL BOARD FOR THE IRON-ORE INDUSTRY

It was announced at a Council meeting of the Cleveland Miners' and Quarrymen's Section of the National Union of General and Municipal Workers held recently at Middlesbrough that a National Joint Board for the iron-ore industry had been established and was expected to have its first meeting in the New Year.

Mr. R. Ewart, who presided, said the Board would consider the position of the industry in the post-war era with a view to co-ordinating all districts concerned with the production of British ironstone and iron ore, and determining policy on a national basis through joint representation of employers' and workpeople's representatives. The new scheme would involve the consideration of rehabilitation, recruitment of manpower, standardisation of holidays-with-pay scheme, normal working week, and national arbitration machinery. Local procedure would not be disturbed.

INDUSTRIAL SALVAGE

The Directorate of Salvage and Recovery of the Ministry of Supply have been engaged for some months past in the formation of industrial salvage groups. Substantial success has already been achieved. The aims of the scheme are principally to keep in front of the minds of industrial concerns the importance of the salvage and recovery of waste materials. Materials which are redundant or useless in one trade may be valuable in another. For example, used conveyor and transmission belting is being used as a substitute for sole leather in boot repairing. The industrial group scheme has also been instrumental in saving many tons of wiper rags which previously were destroyed after use; they can be cleaned and returned to industry at a time when incoming supplies are becoming more and more scarce.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171

Raw Material Markets

IRON AND STEEL

The foundries had several days' break for Christmas, and in the North of England and in Scotland another holiday will be taken at the New Year. There is not at present the pressure for supplies that was experienced at holiday periods earlier in the war. Some of the engineering and jobbing foundries are now less busy than has been the case for a considerable period, and actually could do with more work. It remains a fact, however, that many of the engineering and allied foundries are still very actively engaged on the production of special castings wanted for tank and aircraft components, machine tools, and other work of a vital nature. Fortunately, the necessary special pig-iron to meet the needs of these foundries is available in increased quantities, except perhaps in the case of hematite, the Control being reluctant to increase allocations for this particular grade. Only where no substitute can be found is hematite allocated. Low- and medium-phosphorus irons, as well as refined pig, are available freely, and makers are, in fact, looking out for new business. The demand does not approach the scale of even six months back. The engineering foundries are making use also of ferro-alloys, nickel, etc., and, of course, they want large quantities of steel and cast-iron scrap. Recently, licensed tonnages of scrap have been reduced, forcing the foundries to use more pig-iron.

The light foundries are still short of work. There is plenty of high-phosphorus, home-produced pig-iron to meet all their requirements, which unfortunately do not approach the pre-war scale. It is not considered that there will be much change in the situation, as there is no prospect of export trade becoming possible, and the Board of Trade restrictions on production of domestic goods cut off a lot of trade on which the light foundries depended.

There is an ample supply of foundry coke to meet all needs. Regular deliveries are being effected. Supplies of ganister and limestone also are sufficient to meet the current requirements of the foundries.

The expansion of activity in the finished iron trade is well maintained. There has been a quickening of interest in crown and common iron bars, and some of the makers can only accept further orders with extended delivery dates.

Maximum outputs of open-hearth steel ingots and also alloy steels are still required, although rather quicker deliveries of the latter are now obtainable. The re-rolling mills are all extremely busy, and orders in hand ensure a continuance of these conditions over the whole of the next three months. Hence the importance attached to the maintenance of a regular flow of billets, blooms, sheet bars, etc., from the steel plants to the finishing mills. Re-rollers are not only taking up their full quotas, but are also keen buyers of any defective material, with the possible exception of sheet bars.

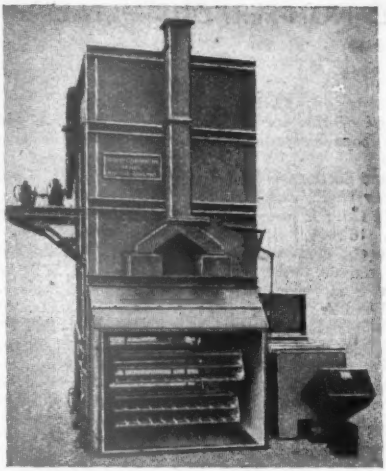
Every plate mill in the country is being worked to the limit of its capacity, and big tonnages of thick sheets are also being rolled for shipbuilders. Moreover, there is not the slightest prospect that any easier conditions will develop. Already the bulk of the output of plates for the next six months is booked, and the utmost care has to be exercised in handling allocations to prevent the holding up of essential work. At the section mills orders for light and medium sizes predominate. Buying interest in joists and heavy structural steels generally has been subdued. The sheet mills have all the work they can handle.

NON-FERROUS METALS

Some relaxation of the restrictions on the use of zinc for galvanising must not be taken to indicate any general change of policy on the part of the Control, which continues to watch the distribution of supplies of all the non-ferrous metals with a jealous eye. It is true that copper, lead and spelter are more plentiful now probably than at any time since the war began, but consumption is still large, and every ton, almost, has to be brought long distances by sea. This question of shipping tonnage is probably the deciding factor at the moment.

As from January 1 next, zinc will be released for the galvanising of a number of articles for which its use had previously been restricted. These are all articles which really need a protective coating, and the Control, mindful of this fact, and presumably having more zinc at its disposal, has relaxed the restrictions accordingly. There is no indication yet that the non-ferrous metals generally will be released any more readily for civilian purposes, but perhaps the time when that will be possible is not so far off as it seems. Lead is a metal which it would appear might be distributed a little more freely, for though consumption is large, it is probably lower than in pre-war days, owing to the ban on private house building. Copper also is now in relatively good supply, with consumption apparently below its peak. Supplies, however, continue to be released only for essential purposes, and against licences to acquire the metal.

Measuring Surface Roughness.—A new profilometer, for providing extremely accurate measurements of surface roughness by direct dial readings, is much lighter and smaller than other such instruments. Known as Type Q, and made by Physicists Research Company, 343, S. Main Street, Ann Arbor, Mich., the instrument has a meter panel set at a 45-deg. angle, thus permitting the operator to remain seated, where formerly he had to stand. It may be used on 115- or 230-volt 50- to 60-cycle power lines. By simply moving a tracer, either manually or automatically, over surfaces of practically any size, shape or degree of roughness, the information is indicated in true inch units on the dial. No computations or other scaling methods are necessary.



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CURRENT PRICES OF IRON, STEEL AND NON-FERROUS METALS

(Delivered, unless otherwise stated)

Wednesday, December 29, 1943

PIG-IRON

Foundry Iron.—CLEVELAND No. 3: Middlesbrough, 128s.; Birmingham, 130s.; Falkirk, 128s.; Glasgow, 131s.; Manchester, 133s. DERBYSHIRE No. 3: Birmingham, 130s.; Manchester, 133s.; Sheffield, 127s. 6d. NORTHANTS No. 3: Birmingham, 127s. 6d.; Manchester, 131s. 6d. STAFFS No. 3: Birmingham, 130s.; Manchester, 133s. LINCOLNSHIRE No. 3: Sheffield, 127s. 6d.; Birmingham, 130s.

(*No. 1 foundry 3s. above No. 3. No. 4 forge 1s. below No. 3 for foundries, 3s. below for ironworks.*)

Hematite.—No. 1 (S & P 0.03 to 0.05 per cent.): Scotland, N.-E. Coast and West Coast of England, 138s. 6d.; Sheffield, 144s.; Birmingham, 150s.; Wales (Welsh iron), 134s. East Coast No. 3 at Birmingham, 149s.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, 140s. 6d., delivered Birmingham.

Scotch Iron.—No. 3 foundry, 124s. 9d.; No. 1 foundry, 127s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, 174s. South Zone, 176s. 6d.

Refined Malleable.—North Zone, 184s.; South Zone, 186s. 6d.

Cold Blast.—South Staffs, 227s. 6d.

(NOTE.—*Prices of hematite pig-iron, and of foundry and forge iron with a phosphoric content of not less than 0.75 per cent., are subject to a rebate of 5s. per ton.*)

FERRO-ALLOYS

(Per ton unless otherwise stated, basis 2-ton lots, d/d Sheffield works.)

Ferro-silicon (5-ton lots).—25 per cent., £21 5s.; 45/50 per cent., £27 10s.; 75/80 per cent., £43. Briquettes, £30 per ton.

Ferro-vanadium.—35/50 per cent., 15s. 6d. per lb. of V.

Ferro-molybdenum.—70/75 per cent., carbon-free, 6s. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, 1s. 3½d. lb.

Ferro-tungsten.—80/85 per cent., 9s. 8d. lb.

Tungsten Metal Powder.—98/99 per cent., 9s. 9½d. lb.

Ferro-chrome.—4/6 per cent. C, £59; max. 2 per cent. C, 1s. 6d. lb.; max. 1 per cent. C, 1s. 6½d. lb.; max. 0.5 per cent. C, 1s. 6½d. lb.

Cobalt.—98/99 per cent., 8s. 9d. lb.

Metallic Chromium.—96/98 per cent., 4s. 5d. lb.

Ferro-manganese.—78/98 per cent., £18 10s.

Metallic Manganese.—94/96 per cent., carb.-free, 1s. 9d. lb.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms and Slabs.—BASIC: Soft, u.t., 100-ton lots, £12 5s.; tested, up to 0.25 per cent. C, £12 10s.; hard (0.42 to 0.60 per cent. C), £13 17s. 6d.; silico-manganese, £17 5s.; free-cutting, £14 10s. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £15 15s.; case-hardening, £16 12s. 6d.; silico-manganese, £17 5s.

Billets, Blooms and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £13 17s. 6d.; basic hard, 0.42 to 0.60 per cent. C, £14 10s.; acid, up to 0.25 per cent. C, £16 5s.

Sheet and Tinplate Bars.—£12 2s. 6d., 6-ton lots.

FINISHED STEEL

[*A rebate of 15s. per ton for steel bars, sections, plates, joists and hoops is obtainable in the home trade under certain conditions.*]

Plates and Sections.—Plates, ship (N.-E. Coast), £16 3s.; boiler plates (N.-E. Coast), £17 0s. 6d.; chequer plates (N.-E. Coast), £17 13s.; angles, over 4 un. ins., £15 8s.; tees, over 4 un. ins., £16 8s.; joists, 3 in. × 3 in. and up, £15 8s.

Bars, Sheets, etc.—Rounds and squares, 3 in. to 5½ in., £16 18s.; rounds, under 3 in. to ⅜ in. (untested), £17 12s.; flats, over 5 in. wide, £15 13s.; flats, 5 in. wide and under, £17 12s.; rails, heavy, f.o.t., £14 10s. 6d.; hoops, £18 7s.; black sheets, 24 g. (4-ton lots), £22 15s.; galvanised corrugated sheets (4-ton lots), £26 2s. 6d.; galvanised fencing wire, 8g. plain, £26 17s. 6d.

Tinplates.—I.C. cokes, 20 × 14 per box, 29s. 9d., f.o.t. makers' works, 30s. 9d., f.o.b.; C.W., 20×14, 27s. 9d., f.o.t., 28s. 6d., f.o.b.

NON-FERROUS METALS

Copper.—Electrolytic, £62; high-grade fire-refined, £61 10s.; fire-refined of not less than 99.7 per cent., £61; ditto, 99.2 per cent., £60 10s.; black hot-rolled wire rods, £65 15s.

Tin.—99 to under 99.75 per cent., £275; 99.75 to under 99.9 per cent., £276 10s.; min. 99.9 per cent., £278 10s.

Spelter.—G.O.B. (foreign) (duty paid), £25 15s.; ditto (domestic), £26 10s.; "Prime Western," £26 10s.; refined and electrolytic, £27 5s.; not less than 99.99 per cent., £28 15s.

Lead.—Good soft pig-lead (foreign) (duty paid), £25; ditto (Empire and domestic), £25; English, £26 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, ex works, £37 12s. 6d.; rolled zinc (boiler plates), ex works, £35 12s. 6d.; zinc oxide (Red Seal), d/d buyers' premises, £30 10s.

Other Metals.—Aluminium, ingots, £110; antimony, English, 99 per cent., £120; quicksilver, ex warehouse, £68 10s. to £69 15s.; nickel, £190 to £195.

Brass.—Solid-drawn tubes, 14d. per lb.; brazed tubes, 16d.; rods, drawn, 11½d.; rods, extruded or rolled, 9d.; sheets to 10 w.g., 10¾d.; wire, 10½d.; rolled metal, 10½d.; yellow metal rods, 9d.

Copper Tubes, etc.—Solid-drawn tubes, 15½d. per lb.; brazed tubes, 15½d.; wire, 10d.

Phosphor Bronze.—Strip, 13¾d. per lb.; sheets to 10 w.g., 14¾d.; wire, 16d.; rods, 16d.; tubes, 21½d.; castings, 19d., delivery 3 cwt. free. 10 per cent. phos. cop. £35 above B.S.; 15 per cent. phos. cop. £43 above B.S.; phosphor tin (5 per cent.) £40 above price of English ingots. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 10d. to 1s. 4d. per lb.; rolled to 9 in. wide, 1s. 4d. to 1s. 10d.; to 12 in. wide, 1s. 4½d. to 1s. 10½d.; to 15 in. wide, 1s. 4½d. to 1s. 10½d.; to 18 in. wide, 1s. 5d. to 1s. 11d.; to 21 in. wide, 1s. 5½d. to 1s. 11½d.; to 25 in. wide, 1s. 6d. to 2s. Ingots for spoons and forks, 10d. to 1s. 6½d. Ingots rolled to spoon size, 1s. 1d. to 1s. 9½d. Wire round, to 10g., 1s. 7½d. to 2s. 2½d., with extras according to gauge. Special 5ths quality turning rods in straight lengths, 1s. 6½d. upwards.

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Controlled Maximum Prices.—Bright untinned copper wire, in crucible form or in hanks, £57 10s.; No. 1 copper wire, £57; No. 2 copper wire, £55 10s.; copper firebox plates, cut up, £57 10s.; clean untinned copper, cut up, £56 10s.; braziery copper, £53 10s.; Q.F. process and shell-case brass, 70/30 quality, free from primers, £49; clean fired 303 S.A. cartridge cases, £47; 70/30 turnings, clean and baled, £43; brass swarf, clean, free from iron and commercially dry, £34 10s.; new brass rod ends, 60/40 quality, £38 10s.; hot stampings and fuse metal, 60/40 quality, £38 10s.; Admiralty gunmetal, 88-10-2, containing not more than ½ per cent. lead or 3 per cent. zinc, or less than 9½ per cent. tin, £74 10s., all per ton, ex works.

Returned Process Scrap.—(Issued by the N.F.M.C. as the basis of settlement for returned process scrap, week ended Dec. 25, where buyer and seller have not mutually agreed a price; net, per ton, ex-sellers' works, suitably packed):—

Brass.—S.A.A. webbing, £48 10s.; S.A.A. defective cups and cases, £47 10s.; S.A.A. cut-offs and trimmings, £42 10s.; S.A.A. turnings (loose), £37; S.A.A. turnings (baled), £42 10s.; S.A.A. turnings (masticated), £42; Q.F. webbing, £49; defective Q.F. cups and cases, £49; Q.F. cut-offs, £47 10s.; Q.F. turnings, £38; other 70/30 process and manufacturing scrap, £46 10s.; process and manufacturing scrap containing over 62 per cent. and up to 68 per cent. Cu, £43 10s.; ditto, over 58 per cent. to 62 per cent. Cu, £38 10s.; 85/15 gilding metal webbing, £52 10s.; 85/15 gilding defective cups and envelopes before filling, £50 10s.; cap metal webbing, £54 10s.; 90/10 gilding webbing, £53 10s.; 90/10 gilding defective cups and envelopes before filling, £51 10s.

Cupro Nickel.—80/20 cupro-nickel webbing, £75 10s., 80/20 defective cups and envelopes before filling, £70 10s.

Nickel Silver.—Process and manufacturing scrap: 10 per cent. nickel, £50; 15 per cent. nickel, £56; 18 per cent. nickel, £60; 20 per cent. nickel, £63.

Copper.—Sheet cuttings and webbing, untinned, £54; shell-band plate scrap, £56 10s.; copper turnings, £48.

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Middlesbrough.—Short heavy steel, 79s. 9d. to 82s. 3d.; heavy machinery cast iron, 91s. 9d.; ordinary heavy cast iron, 89s. 3d.; cast-iron railway chairs, 89s. 3d.; medium cast iron, 79s. 6d.; light cast iron, 74s. 6d.

Birmingham District.—Short heavy steel, 74s. 9d. to 77s. 3d.; heavy machinery cast iron, 92s. 3d.; ordinary heavy cast iron, 87s. 6d.; cast-iron railway chairs, 87s. 6d.; medium cast iron, 80s. 3d.; light cast iron, 75s. 3d.

Scotland.—Short heavy steel, 79s. 6d. to 82s.; heavy machinery cast iron, 94s. 3d.; ordinary heavy cast iron, 89s. 3d.; cast-iron railway chairs, 94s. 3d.; medium cast iron, 77s. 3d.; light cast iron, 72s. 3d.

(Note.—*For deliveries of cast-iron scrap free to consumers' works in Scotland, the above prices less 3s. per ton, but plus actual cost of transport or 6s. per ton, whichever is the less.*

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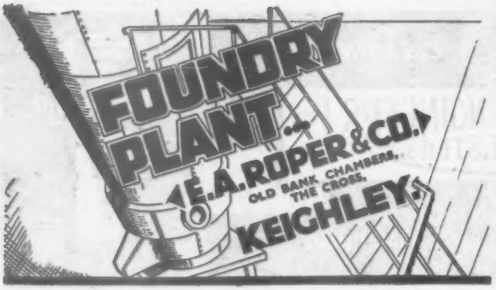

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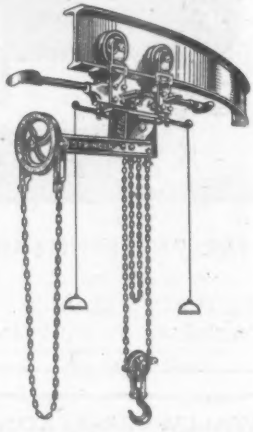

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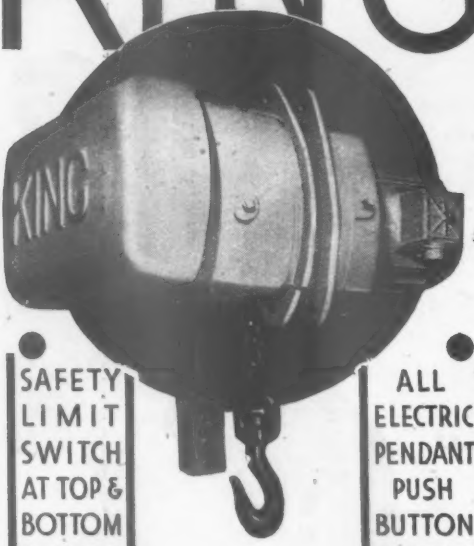

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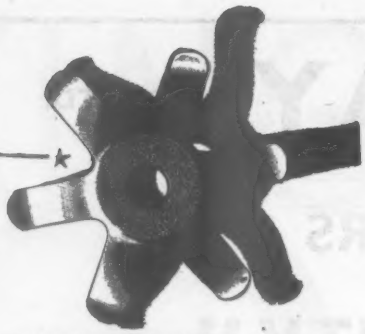

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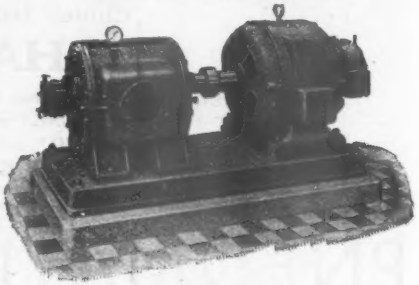

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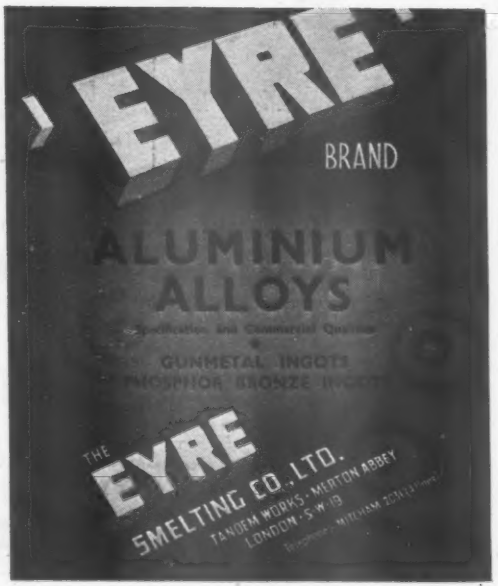

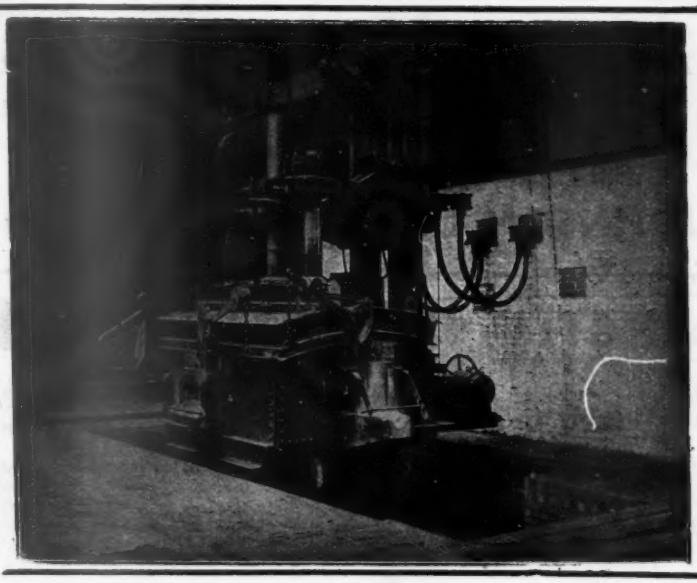

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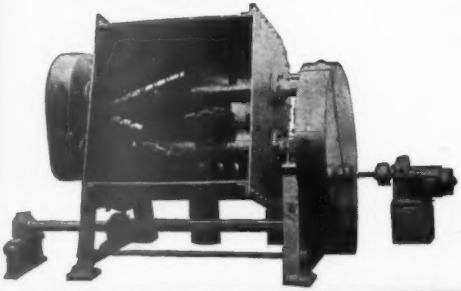

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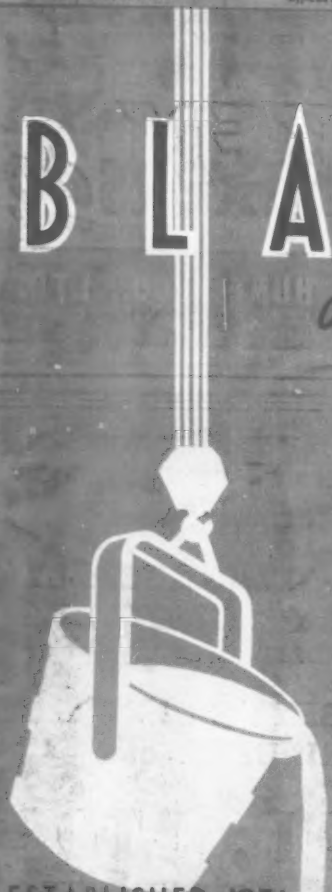

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